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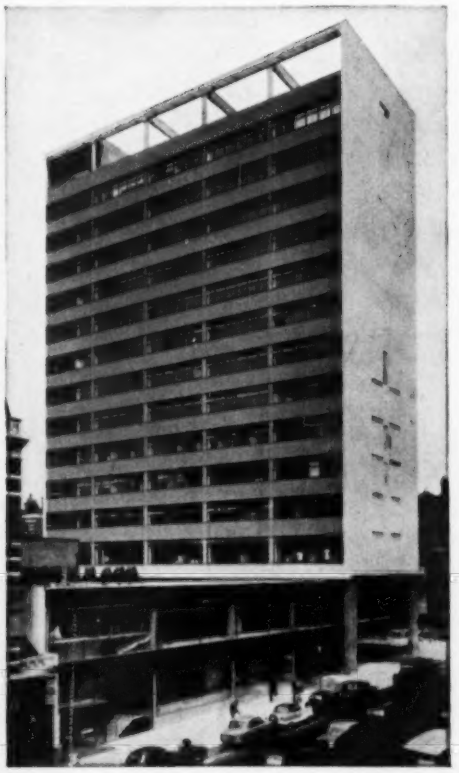

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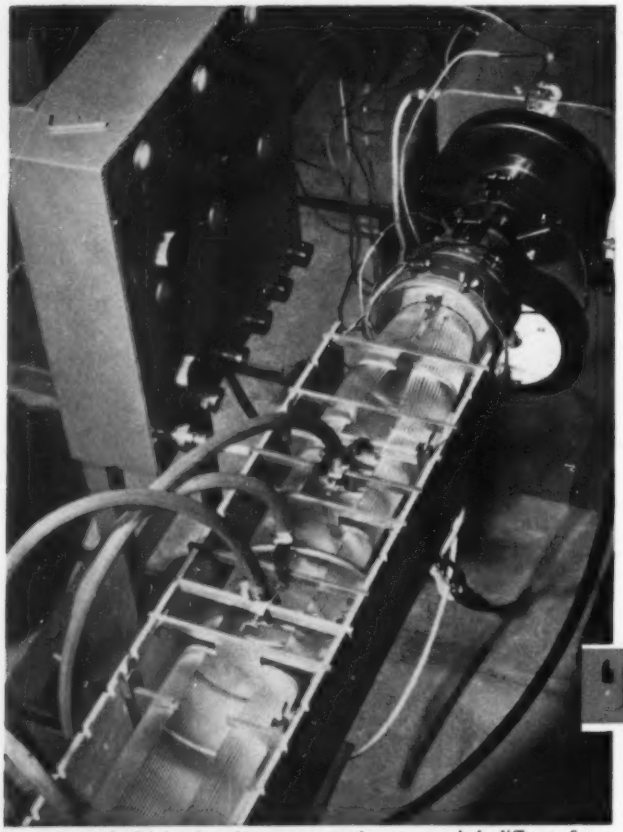

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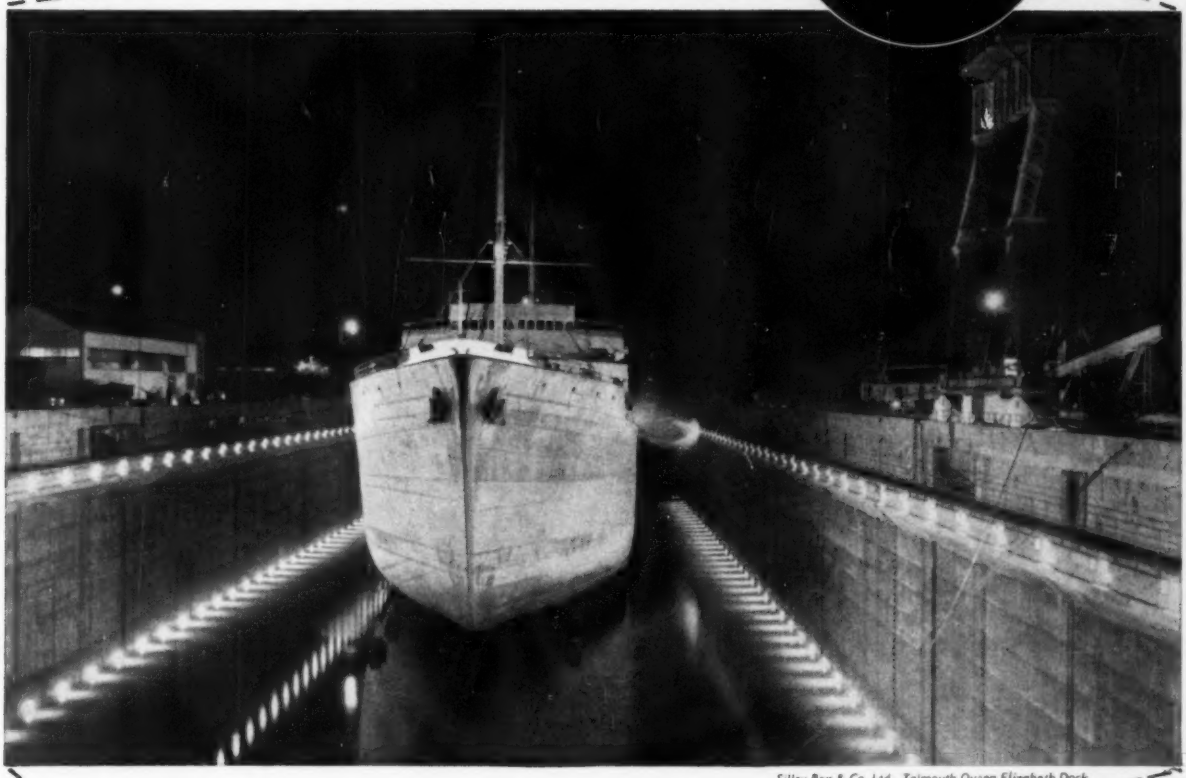

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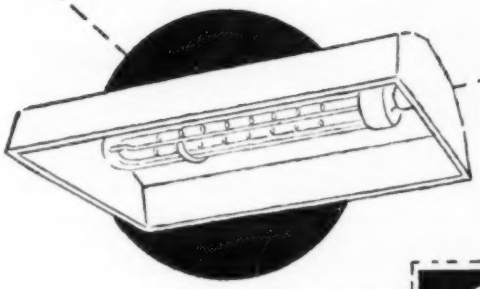

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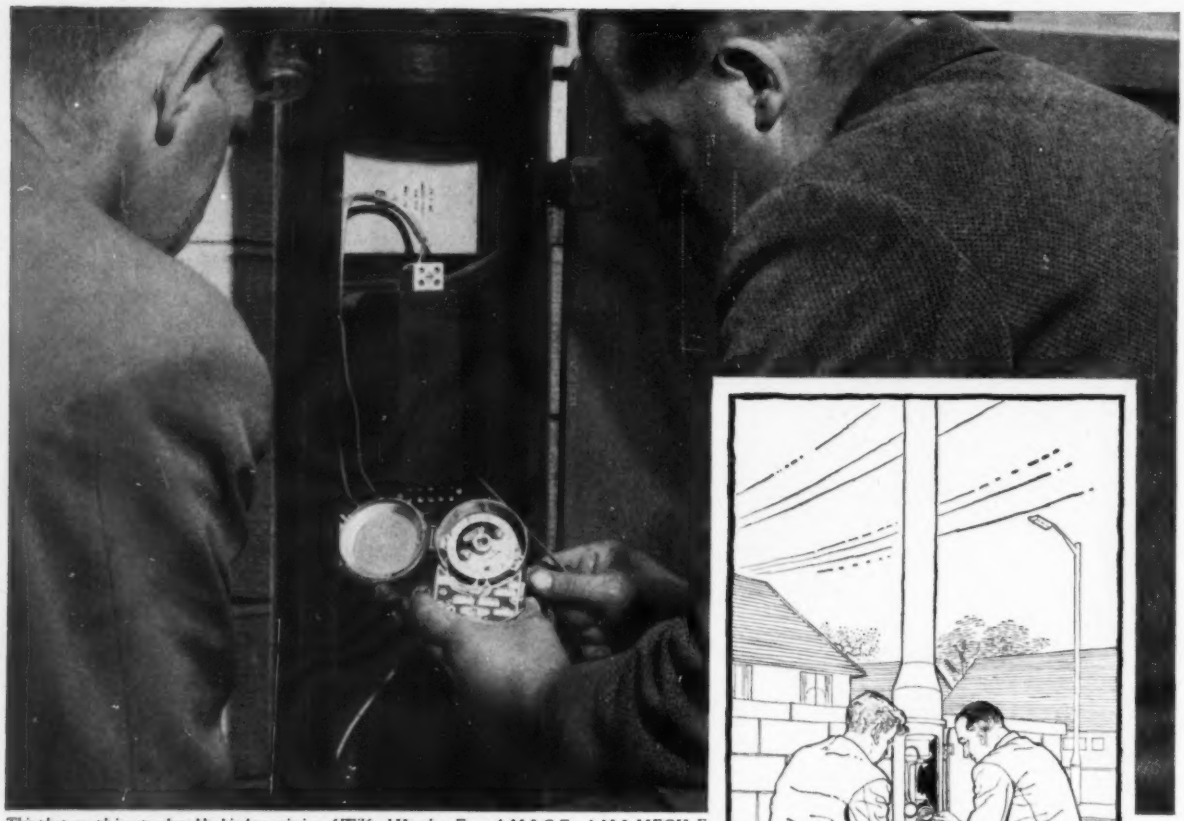

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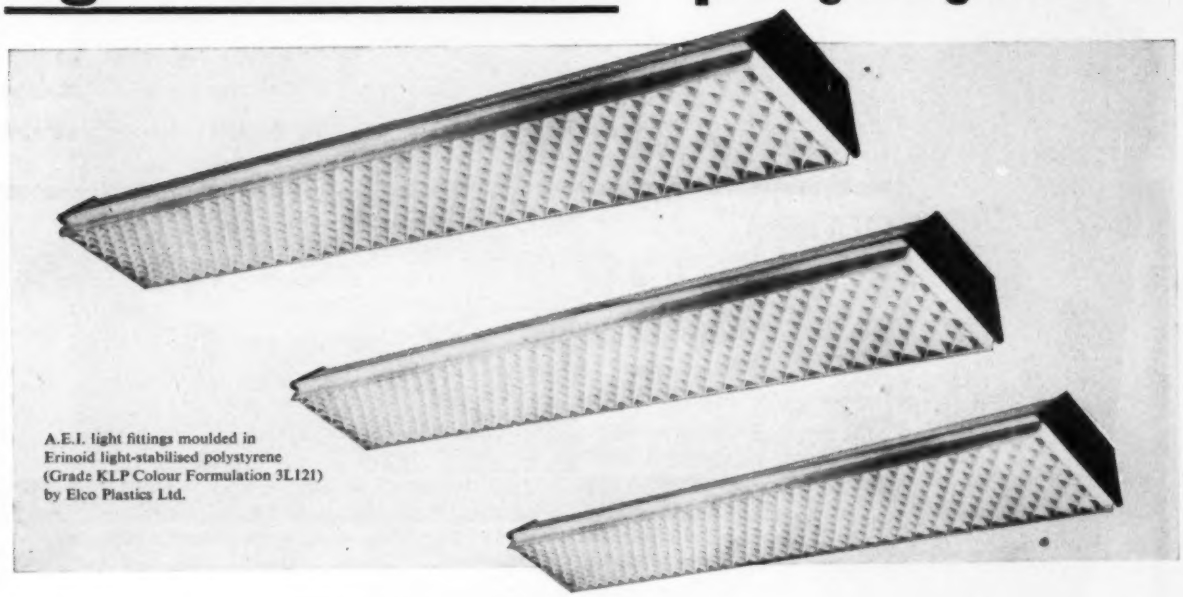

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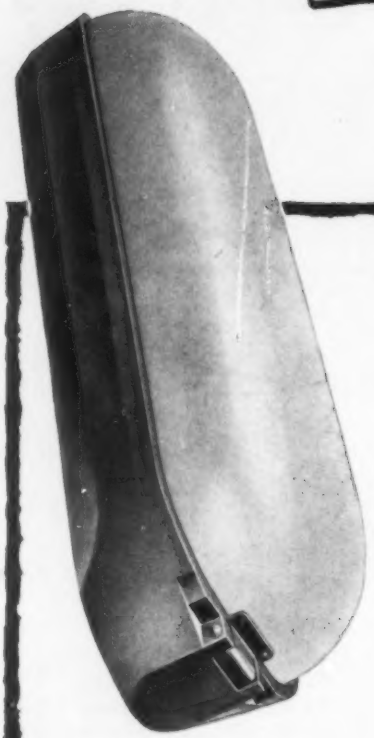

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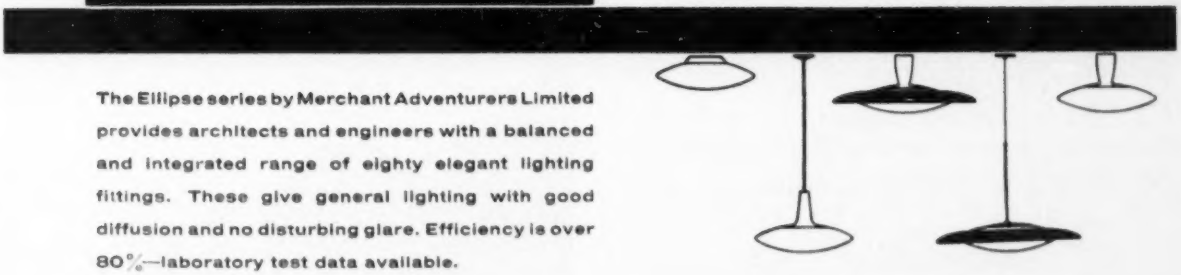

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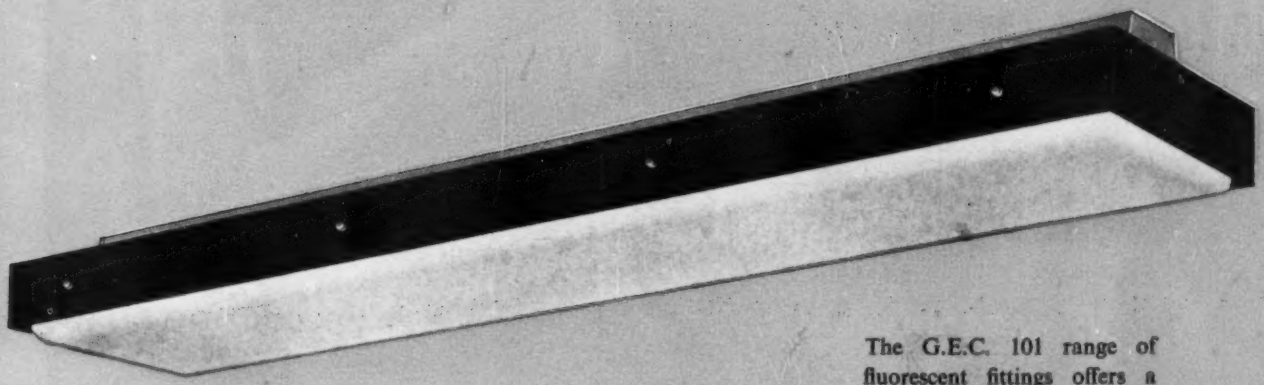

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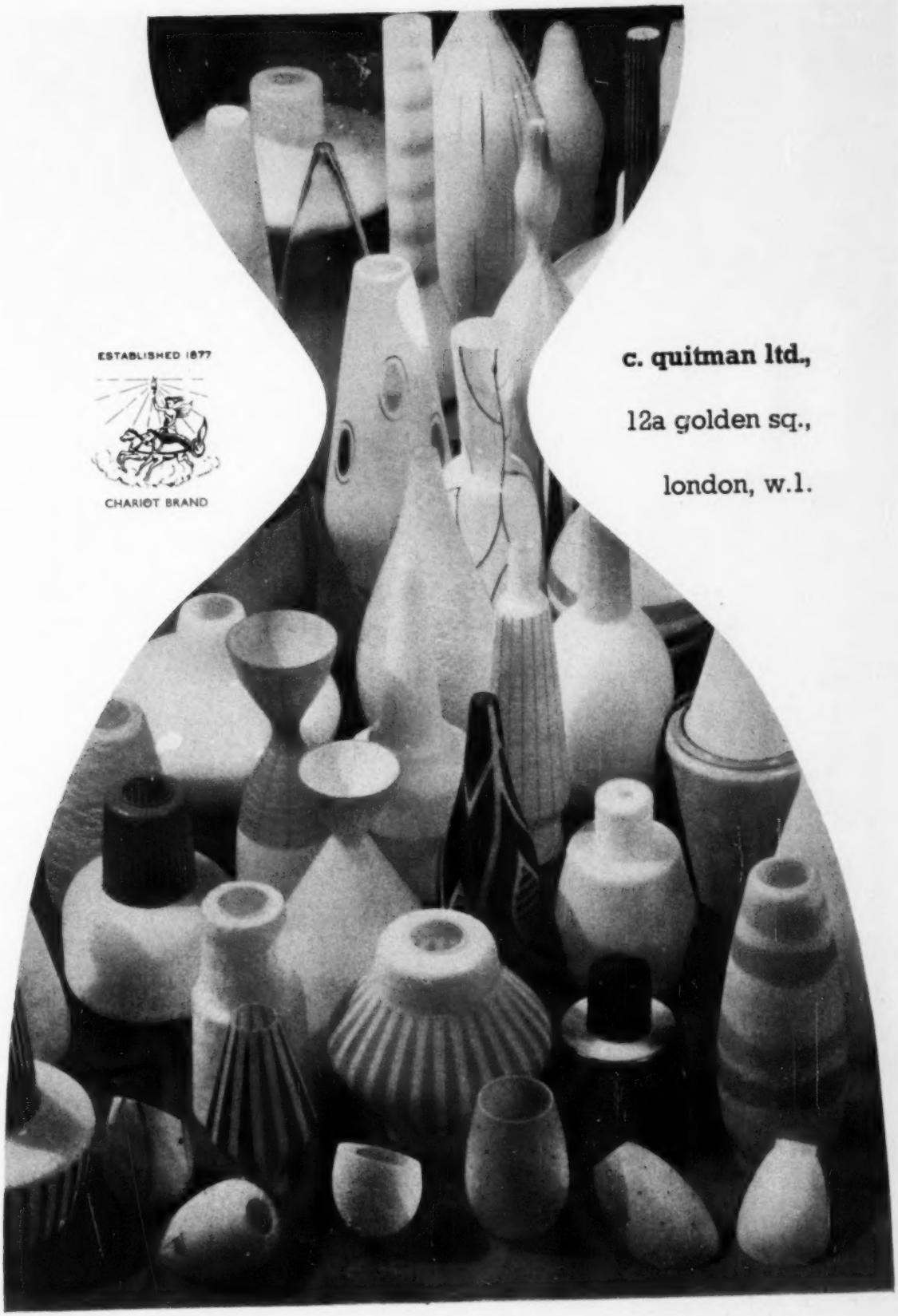
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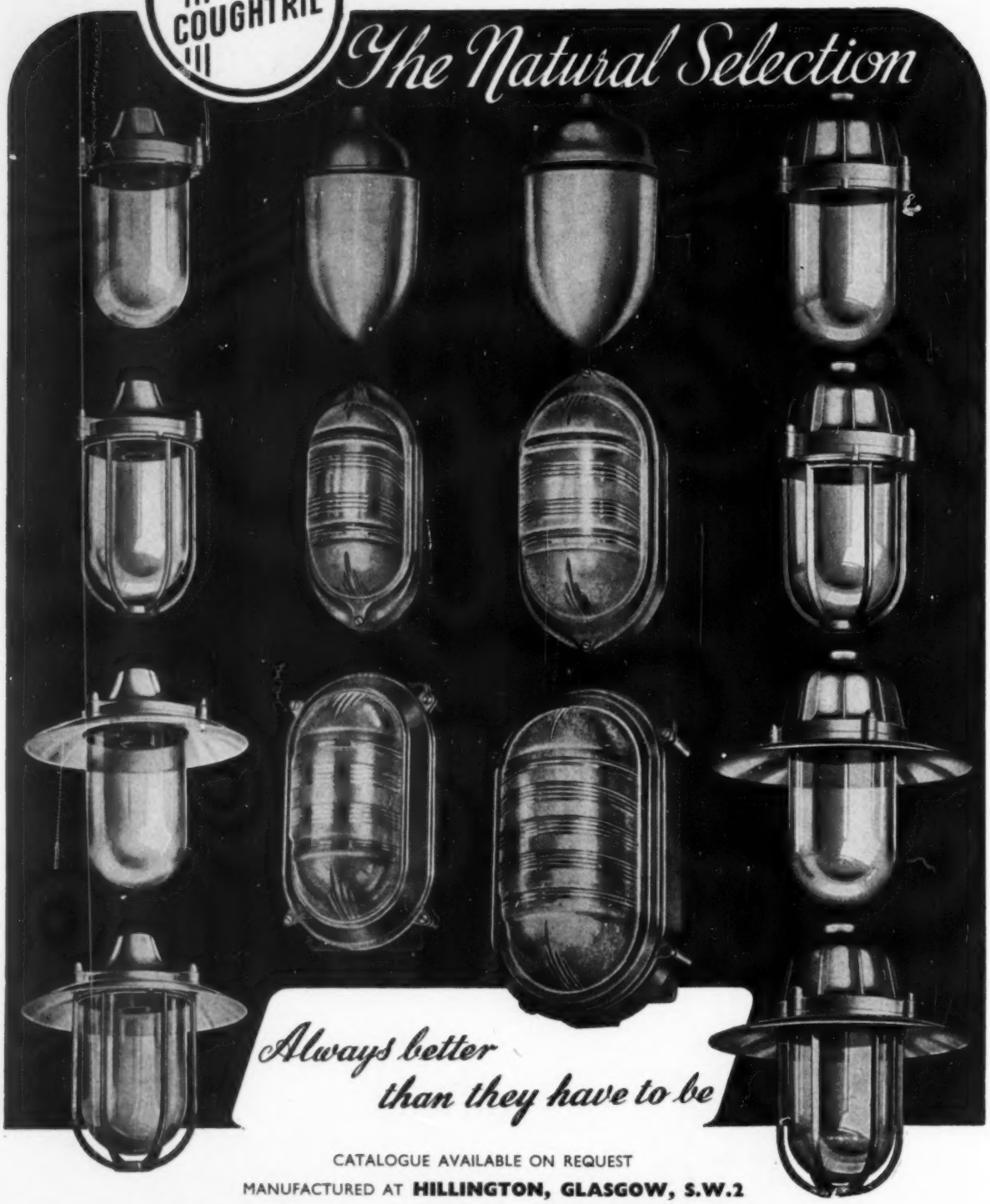

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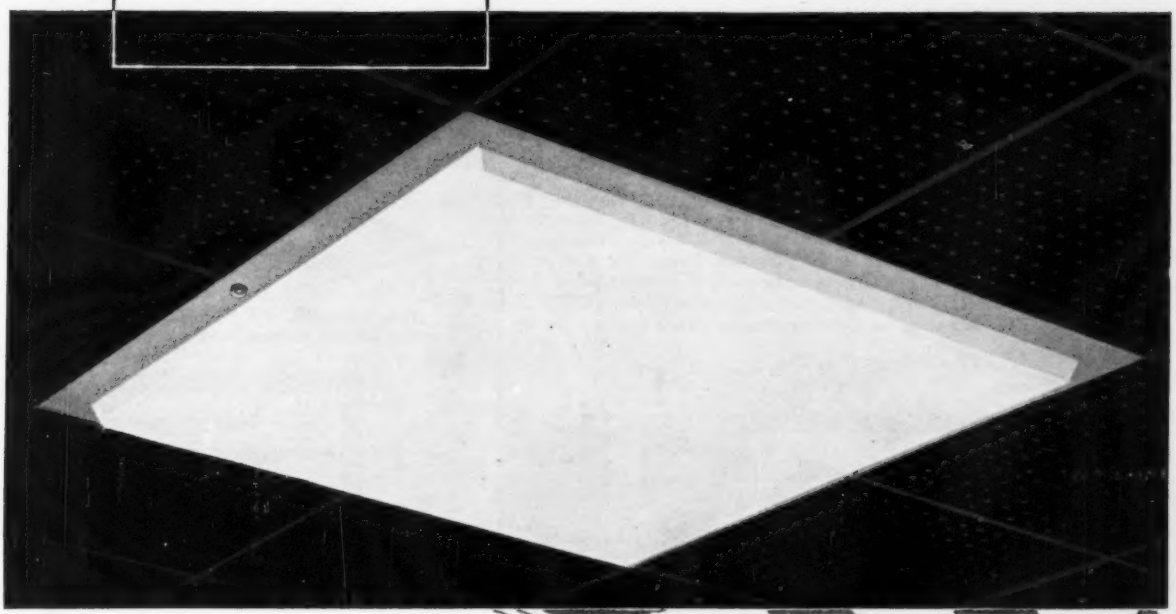

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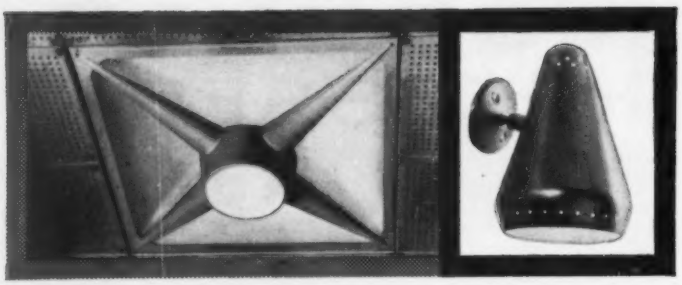

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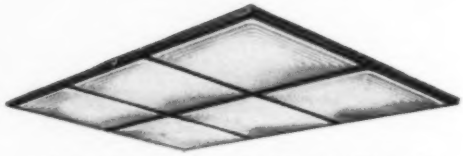

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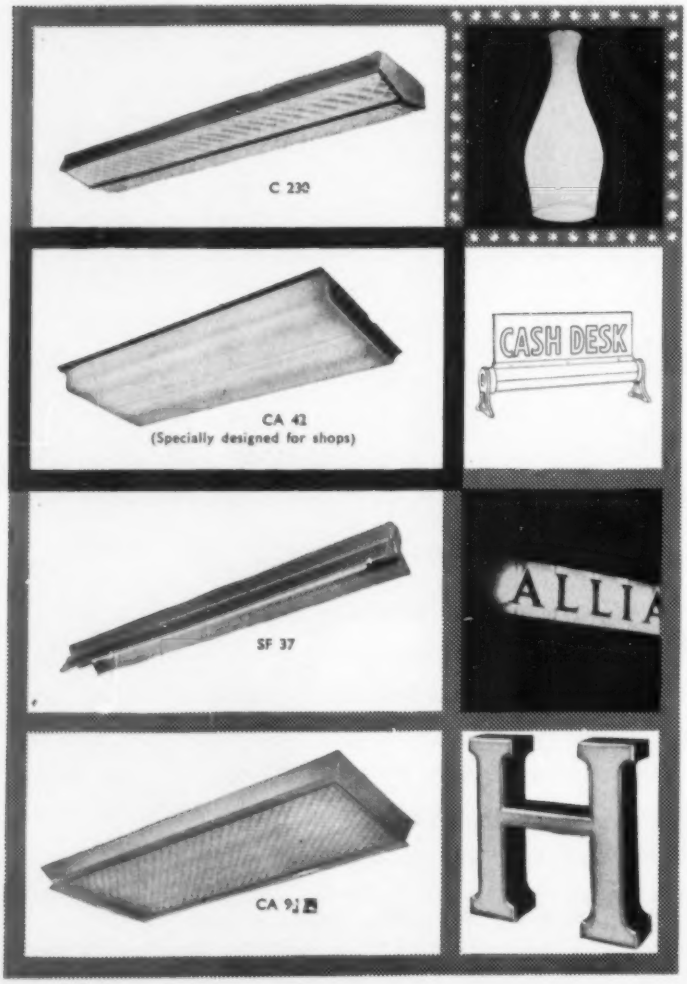

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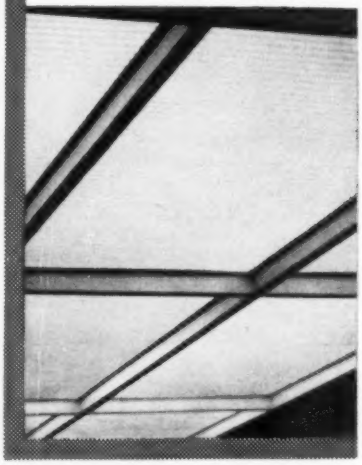

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Light and LIGHTING

Vol. 52 No. 12 December, 1959

Published by The Illuminating Engineering Publishing Co. Ltd. on the 1st of each month at 32, Victoria Street, London, S.W.1. Telephone: ABBey 7553. Subscription rate 30s. per annum.

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Festive Lighting

ONCE again, as the festival of Christmas approaches, festive lighting is to be seen in and out of shops, in homes and in more than one famous street in our great metropolis. If we did not know it very well already, the crowds that have flocked to see the Christmas lighting of Regent Street would "speak" eloquently of the pleasure that can be given by what are still popularly called "illuminations". The lure of lights massed in decorative arrays is unfailing. Their purpose is not primarily to illuminate a scene—an environment—but to be themselves a scene. They are the objects of view, and the light they shed upon their surroundings is of secondary importance and, sometimes, of no importance at all. There is thus a fundamental difference of purpose between lights to be seen in their own right and lights for bringing other things to sight, and this difference accounts for—among other "reactions"—the welcome accorded in festive lighting to what, in quite other circumstances, is termed "glare". Few, if any, lightings that are "blameless" as to their "revealing power" are exciting and intrinsically enjoyable: they are not meant to be.

Thorn House

Architects, Basil Spence, ARA, and Partners; architects for showroom, John and Sylvia Reid, A/ARIBA, F/FSIA; structural engineers, Ove Arup and Partners; electrical and mechanical engineers, A. F. Myers and Partners. General contractor, Bovis Ltd.; electrical installation, Barlow and Young Ltd.; stainless steel street lighting standards in showroom, J. Starkie Gardner Ltd.; lift motors and gear for lighting display, Atlas Theatre Lighting Department; dial-operated control equipment, Siemens Edison Swan Ltd.

THORN HOUSE, the new headquarters of Thorn Electrical Industries, occupies a site between Upper St. Martin's Lane and Charing Cross Road. This area, known as Seven Dials, was once a fashionable part of the West End, though architecturally it has been sadly neglected for many years.

Instead of developing the 2,700 sq. yd. site in a manner that has become all too familiar—i.e., by building an eight-storey block around the perimeter of the available land—the architects have achieved the same accommodation by building upwards over a small part of the site, leaving the remainder open to the public and turning an otherwise uninteresting street corner into an attractively landscaped piazza.

The buildings consist of an office tower of 14 floors rising 184 ft. above the street, and a long, low showroom block, with two storeys above ground level, the interior of which has been designed to display the varied products of the company. There is a basement car-park and additional car-parking space at ground level.

The entrance to the showrooms is at ground level from St. Martin's Lane and the offices can also be reached from this street by walking under the showrooms and up a flight of stairs into the 20 ft. high, glass-walled lift hall with its bank of four 700ft/minute lifts. The showrooms, including basement display area, have a floor area of 7,000 sq. ft., while on each floor of the tower block there is 4,000 sq. ft. of office space.

On top of the tower block is an open area accessible to the occupants of the building from which magnificent views can be obtained—of the City, Hampstead and Highgate to the north and of Westminster, the river and the North Downs to the south. The structure is of reinforced concrete (the framing of the tower having been erected at the rate of one floor per week). There are continuous bands of windows on the north and south façades, with spandrel panels faced with mosaic, the upper panes being of non-actinic glass to reduce excessive heating from direct sunlight.

Ground floor lighting

Lighting of the ground floor area has been carefully integrated with the architectural form. The main entrance area from Upper St. Martin's Lane has been strongly defined by recessing into the soffit of the showroom two lines each of 25 tungsten downlights. Each fitting houses a 100-watt lamp, having a shallow opal-glass dish diffuser with a silver-finished soffit ring.

On reaching the main forecourt, having passed under the showroom and up the granite steps, the lighting atmosphere changes. The forecourt is lit dimly by 3-in. diameter fittings recessed into the paving in a regular pattern at 80-in. centres. There are 71 fittings, each housing a 25-watt lamp, with toughened opal-glass covers set flush with the paving.

By contrast, the entrance foyer is very brightly lit. Enclosed on two sides by glass walls, its interior is visible when approached from across the forecourt and from the open north side of the tower block. The lighting comes from a number of split cylinders of differing diameters, lengths and materials, asymetrically arranged and housing tungsten lamps. Approximately 60 of these cylindrical fittings are suspended from a ceiling grid made from "Unistrut" trunking, finished matt black. The cylinders hook directly on to the suspension grid, varying in size from 42 in. diameter x 72 in. high to 9 in. diameter x 27 in. high. The lamps range from 1,000-watt g.l.s to 12-volt 50-watt reflector lamps. Finish of the cylinders includes aluminium, copper and matt-black paint.

This foyer lighting is highly directional and relatively little light reaches the walls. This prevents light from being spilt through the glass walls on to the forecourt (which would lessen the drama of the scheme) and also allows the low-brightness lift-position indicators on the rear wall to show up clearly. These indicators consist of 12 in. x 2 in. electro-luminescent panels, the twelve panels for each lift being arranged vertically above the lift opening extending upwards to the ceiling of the foyer. The energisation of the panels is controlled by the movement of the lifts and, in addition to showing the position of each lift, the lighting up of the panels creates a continually changing pattern of light over the entire area of the lift enclosure wall.

The indicator panels operate on 350-volt 400-cycle current (obtained from a thermionic-valve frequency changer) applied through relays operating on the 110-volt supply of the lift control system. The functioning of the relays is audible, thus drawing attention to the operation of the indicators. Arrival of a lift at ground floor level is indicated by the lighting up of a special fitting comprising an edge-lit "Perspex" dish, engraved with a star pattern, the light source being a 12-volt 50-watt lamp.

An interesting feature of the lift operation, incidentally, are the call buttons. These "touch buttons" (they cannot be depressed) have no moving parts. Calls are registered by the striking of a miniature gas discharge lamp through the capacitor effect of the person touching the button. The discharge lamp also serves as a visual indicator that the call has been registered by the lift-control mechanism. No magnetic relays are required and incandescent call-register lamps are eliminated.

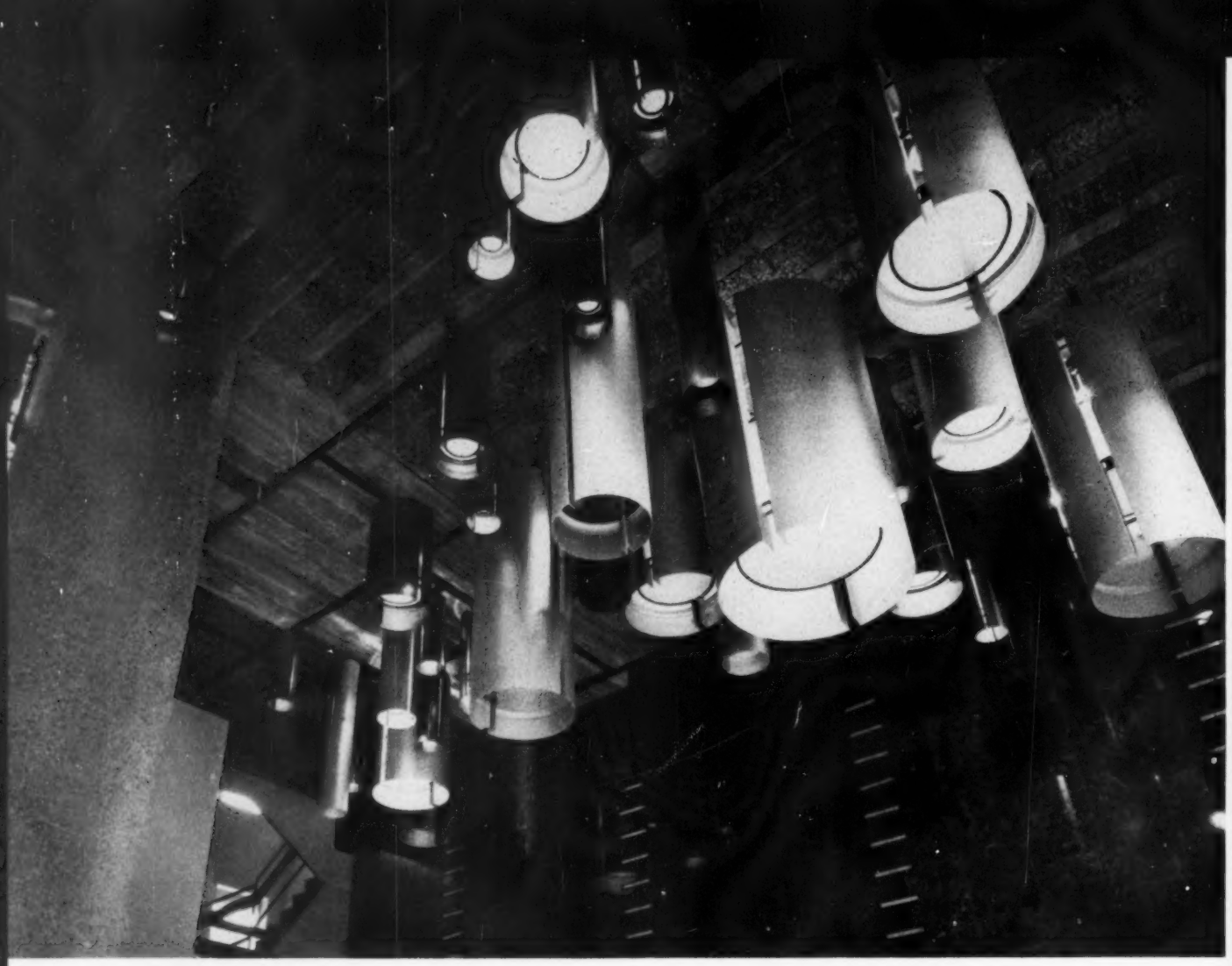
The total lighting load for the foyer is 33kW, but a staggered switching arrangement is provided to give all-night foyer lighting at a reduced level. A special control room has been built at mezzanine level at the west end of the tower block, reached *via* a staircase leading up from the entrance foyer. The switching and relay panels in this room provide remote control over contactor units in various parts of the building, thus making possible centralised remote control for all miscellaneous services, such as the lighting of the lift lobbies, staircase and forecourt; the exterior floodlighting; and the operation of the portcullis gates.*

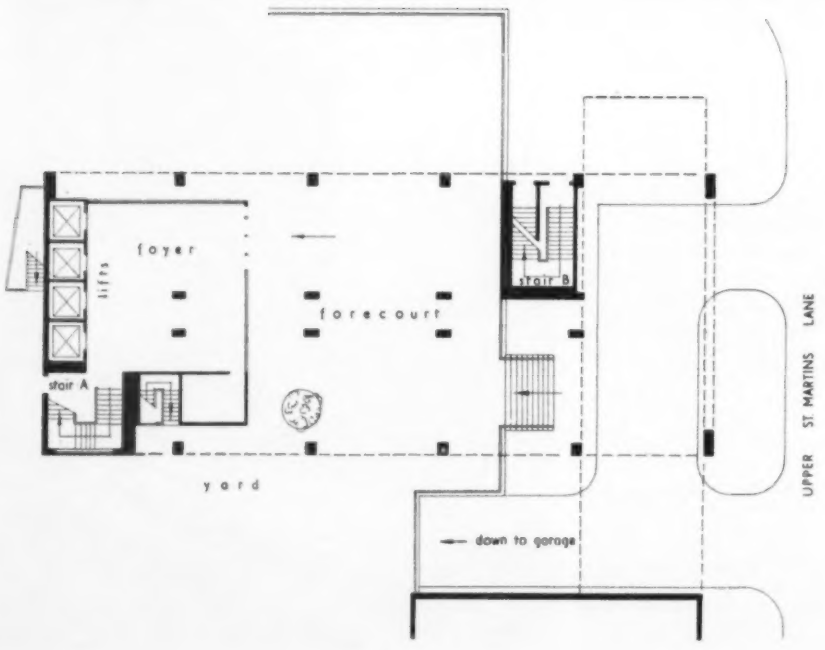
Exterior floodlighting

The south face of the main tower block is floodlit at night by eleven 3kW 'Infranor' projectors mounted on the extreme southern end of the showroom roof. These projectors, it is claimed, are the first of their type to be used for the permanent floodlighting of a building in the UK.

*Due to the open nature of the forecourt planning, a series of vertically barred portcullis gates have been fitted along the north and east sides of the tower block and showrooms. At night, when the offices are vacated, these gates are lowered electrically and the inner forecourt, foyer and basement garage areas are thus enclosed.

Right, general view of the new headquarters, showing south façade of tower block; east façade, to which Geoffrey Clarke's six tons of sculpture is to be affixed and, on extreme left of showroom roof, the projectors for the floodlighting of the tower. At the top of the facing page, one of the magnificent views that can be obtained from the upper floors of the building.





Left, ground floor plan of tower block, showing how most of the site area is left open for pedestrian circulation. Above, ceiling of entrance foyer (of exposed aggregate concrete) from which are suspended about sixty split cylinders of aluminium, copper and matt-black finish. They house lamps of various types from 1,000-watt gls to 12-volt 50-watt reflector lamps. The wall facing the camera conceals the four lifts; on it can be seen the electro-luminescent panels that indicate the positions of the lifts.

They feature an optical system that produces a rectangular beam of light. By suitable orientation of the lanterns, the entire wall area is evenly lit to about 10 lm/ft², without stray light falling beyond the rectangular outline of the façade. In addition to the effect produced by the floodlighting of the bluish-grey mosaic of this façade, the white concrete columns and beams of the roof pergola structure are lit, as a contrast, by fifteen 8-ft. 125-watt gold fluorescent lamps, these lamps being housed in special fittings mounted along the south face of the building at roof level. They are fixed between the main wall face and the hand-rail which is provided at waist level around the roof garden.

An important external feature of the tower block is its east wall, which comprises an uninterrupted plane of Derbydene stone 160 ft. high x 54 ft. wide. To be centrally placed on the lower half of this wall is a work of sculpture in bronze by the artist Geoffrey Clarke. This work, which is 85 ft. high and weighs about 6 tons, is intended to symbolise the company's various electronic activities. Its lighting is integral with its design, the light sources—12 volt 50-watt reflector lamps—being built into it.

Basement garage

The basement of the tower block is taken up by service areas, including the room for the air-conditioning plant for the showroom, and a garage. Lighting for the latter is from an experimental high-frequency system using a 3-phase 400-cycle 240-volt generator. Specially designed lighting fittings, with flat plastic diffusers, each house one 4-ft. 40-watt fluorescent lamp. The diffusers have a large surface area—48 in. x 12 in.—and, as there is no upward light, they give the impression of a false ceiling, drawing attention away from the surface-mounted service runs.

So that the rotary convertor set, located in the boiler room, may be disconnected from service, two rows of fittings in the garage have additional control gear for 50-cycle operation that comes on automatically whenever the 400-cycle supply is switched off.

Tower block

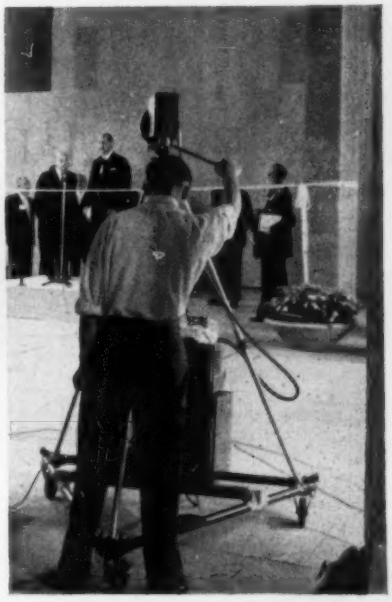
In the twelve office floors of the tower block particular attention has been paid to flexibility of use. The principal means by which this has been achieved are: the well-disciplined grid layout, both in plan and in section; the design of the ceiling system and the partitioning used for subdividing the office areas; and the underfloor arrangement of services for GPO and internal telephones.

The basic design module is 10 in. and, wherever possible, all dimensions are multiples of this. The general planning grid is 50 in.—in both directions; all services run across the building (a dimension of 50 ft.); and windows, except where interrupted by the columns, run the entire length of the north and south façades, extending from the height of the suspended ceiling to the sill level of the spandrel panels, 40 in. above floor level.

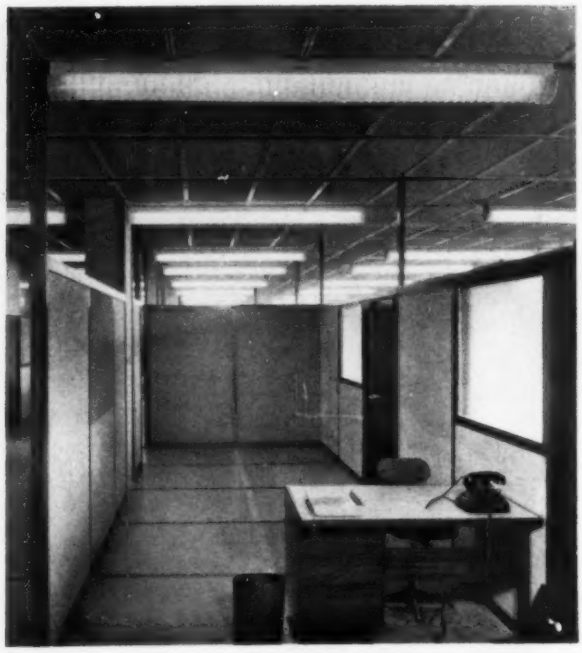
The suspended ceiling comprises extruded aluminium trunking specially designed, as a joint project, by the architects and by Atlas Lighting Ltd. This trunking runs across the building at 50-in. centres—i.e., on every north/south grid line—and is supported from the structural ceiling at every grid intersection. The trunking itself supports 50 in. by 25 in. trays of expanded metal, finished blue-grey, with frames made from rolled steel sections finished with white stove enamel. A glass-wool sound-absorbent mat is laid over the expanded metal and each frame simply rests, through four rubber pads, on shoulders formed on the extruded section of the trunking. The trays are, therefore, easily removed from below without tools.

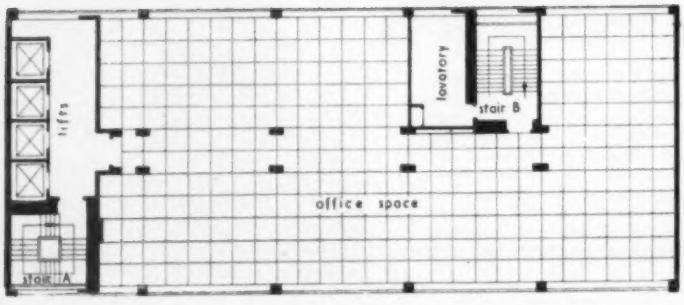
The trunking can support lighting fittings at any posi-

The Opening Ceremony

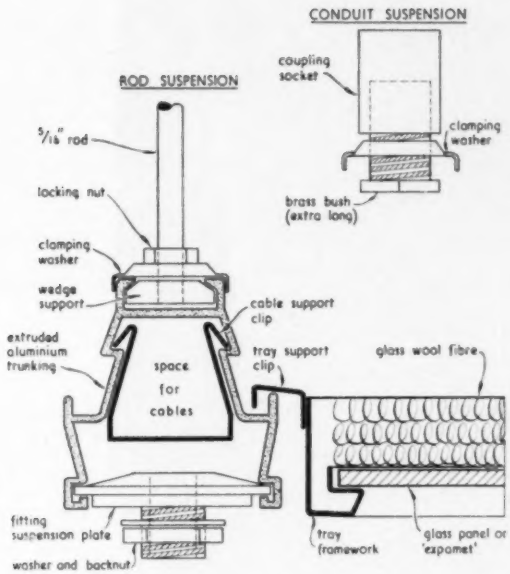


Thorn House was opened on Monday, September 7th, by Jules Thorn, Chairman and Managing-Director of Thorn Electrical Industries Ltd. The ceremony took place on the forecourt of the building where Mr. Thorn was accompanied by his fellow directors; by the Deputy Mayor of Westminster, Councillor David Cobbold; by Andrew Renton, representing the architect Basil Spence; and by Don Mitchell, President of Sylvania Electric Inc. (of the USA) with which company Thorn are associated. Mr. Thorn pressed a button to raise electronically a portcullis that encloses the inner forecourt, this ceremony being televised (right) and watched, through a closed-circuit installation, by an audience of guests on the 11th floor of the building (above).





Left, typical floor plan of office block showing grid lines at 50-in centres.
Above, office areas on four different floors, each lit by different types of fluorescent fitting from the various Atlas ranges. In the two examples on the left the fittings are in rows parallel to the windows (i.e., at right angles to the service trunking); in the two examples on the right, the fittings are at right angles to the windows (i.e., along the lines of the trunking from which they are supported).



Left, section through 'Integral' extruded aluminium trunking and expanded metal trays of suspended ceiling system.

tion at right angles or parallel to its length. Fluorescent fittings can also span between adjacent runs of trunking. Where recessed fittings have been used—mainly in executive offices—the sound-absorbent trays have been replaced with plastic diffusers of equal dimensions and a fluorescent lighting fitting has been arranged above.

Each floor of the tower block has been equipped with different types of fluorescent fitting so that customers visiting the building can see several full-scale applications of fittings from the ranges of Atlas Lighting Ltd.

In addition to supporting the acoustic ceiling panels and lighting equipment, the aluminium trunking acts as a top support for the inter-office partitioning. This partitioning is always arranged on the 50-in. grid lines which, for easy location, are marked on the floor by narrow bands of linoleum of darker or lighter hue. It is made in units 50 in. wide and in two heights—80 in. and 120 in., the latter being the full height to the suspended ceiling. The vertical partition posts of mahogany fit into the mouth of the overhead trunking and are held in position by screw-operated jacks in the foot of each post. As posts can occur only at grid intersections, they also always coincide with a trunking support from the structural ceiling, thus ensuring adequate rigidity. Infill panels (some solid, some part-glazed) are of blockboard faced with mottled-grey pvc-coated fabric, with some areas of cork-board for pin-up purposes.

The open mouth of the aluminium trunking, where it is not covered by partitioning or by lighting fittings, is enclosed by clip-on extruded pvc cover strip (black in colour), this material being easily trimmed when changes are made to partitioning or lighting arrangements by cutting with ordinary scissors.

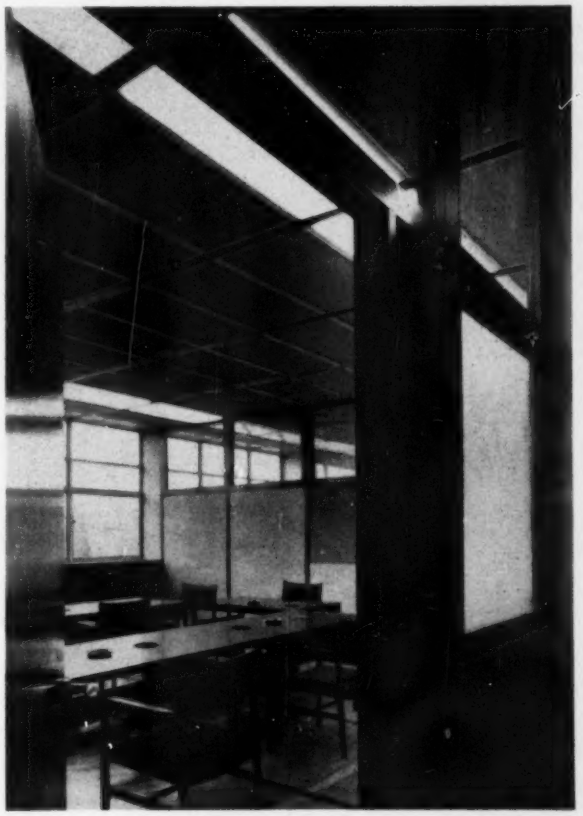
All windows on the south side of the tower are fitted with venetian blinds, each separately controlled by hand-winding mechanism.

Reflecting the overhead trunking system are a series of floor ducts for telephone cables, also at 50-in. centres, making possible telephone connections at any point on the transverse grid lines. To avoid their being covered by partitioning, these ducts—of half-round fibre below the floor screeding—have been arranged 5 in. to one side of the grid lines across the building.

Experimental installations

At the east end of the fourth floor of the tower block there is an experimental installation of permanent artificial lighting supplementing daylight. Carried out in collaboration with the Building Research Station, the installation comprises six rows of fluorescent fittings, each housing four 4-ft. 40-watt lamps with opal diffusers, each row running parallel with the windows. A special 'daylight' switching cycle arranges that all lamps in the rows of fittings nearest the windows are 'off'; that two lamps in each fitting of the next rows are 'on'; and that *all* lamps in the two central rows are 'on'. This means that the artificial lighting builds up a more intense distribution towards the centre of the room, and the installation has been planned so that, when the natural illumination level close to the windows due to daylight is in the region of 60 lm/ft², an average illumination level of 60 lm/ft² is provided over the entire working area.

After dark, a 'night' switching cycle is used so that three lamps are 'on' in each fitting in *all* rows, providing



Conference room where, as in executive offices, recessed lighting fittings are used. Plastic diffusing panels replace the sound-absorbent trays of the suspended ceilings. Fluorescent fittings for three, four or five 4-ft. 40-watt lamps are fixed above the diffusing panels.

a uniform illumination level of approximately 40 lm/ft^2.

A further lighting research project, on the 12th floor of the tower block, will serve investigations into the application of higher levels of illumination than those at present in use. The aim is to provide a general level of 500-600 lm/ft^2 on the working plane, of which two-thirds would be provided by fluorescent lamps and one-third by directional tungsten filament lighting. It is intended that comparisons should be made between the effects of directional and uniformly diffused lighting arrangements. Angled aluminium louvres will be used to give additional ventilation and switching arrangements will be provided to give different proportions of fluorescent and tungsten lighting.

The main staircase in the south-west corner of the tower block has a central well 50 in. x 60 in. in area which extends the full height of the building. Apart from its emergency lighting, this entire staircase from foyer to 12th floor level is lit by a single lighting fitting mounted at roof level. This fitting has been specially designed to incorporate a filament lamp of 3kW 110-volt rating, the lamp being silvered over half its surface to emit the maximum of light upwards on to a silvered-glass parabolic-shaped reflector 44 in. in diameter. The fitting and lamp can be accurately focused to produce a parallel-sided beam of light 44 in.

in diameter, with a total lumen output of approximately 24,000, which is directed 180 ft. down the well of the stairs.

A series of annular interceptor-diffusers of decreasing diameter are fitted at each floor level, the largest ring (at the 12th floor) being approximately 45 in. across with an internal diameter of 42 in., while the smallest ring (at foyer level) has an internal diameter of 10 in. and is about 20 in. across. The rings are to be constructed of translucent glass-fibre reinforced resin, designed so that at each floor level approximately 1,600 lm will be intercepted from the beam and uniformly distributed on to the staircase walls with negligible loss.

Opposite, view from stairs of first floor showroom. The 'Ferguson' section is in the foreground, with its 'rotunda' inside which a revolving platform enables dealers to view different sets in turn without moving about. Below, ground floor showroom, with coffered ceiling in which lighting fittings are concealed until lowered electrically by use of a telephone dial. In foreground, street lighting lanterns displayed at eye level.

Showroom

Although a very large area of window space is provided in the showroom, the windows are not designed to open and the whole area is, therefore, sealed against the noise and dust of the outside roadway. This has been made possible by the installation of an air-conditioning plant in the basement of the showroom, which operates on the 'comfort-cooling' system. The plant draws in air through a single inlet and passes it through an electrostatic filter unit.

The filtered air supply is fed through three separate ducts which feed the basement, ground and first floor areas respectively. Each of these ducts includes a cooler battery and a heater battery, the latter being fed, in winter, from the main thermal storage tank in the boiler house.

The floor construction is of particular interest, representing, it is said, the first installation of a newly developed system—'Q' floor construction (a product of Robertson Thane Ltd.)—for the complete floor area of a London showroom building. The lower section of the flooring acts both as the reinforcement and the shuttering for the concrete which is laid on top. Together with an upper section, it forms a series of metal-lined ducts approximately 5½ in. x 3½ in. in section, below the concrete screed, at 8 in. intervals.

The ducts run the entire length of both ground and first floor showrooms, parallel with the windows. In order to provide easy access to them, a series of cross or header ducts are provided at convenient intervals of approximately 20-30 ft. These header ducts are arranged in pairs (about 12 in. apart), the first giving access to the first, third, fifth and other odd ducts, while the second gives access to the second, fourth, sixth and all other even ducts. A special feature of the 'Q' floor in these showrooms is that the header ducts have access covers running the whole width of the showroom, thus allowing complete freedom for interconnections between ducts. Hence, half the 'Q' floor ducts are available for the accommodation of mains voltage cables, for lighting and plug outlets, while the intermediate, but completely separated, ducts are available for low-voltage bell and telecommunication cables.

The 'Q' floor system is connected to cable ducts feeding directly down to the main showroom intake and the whole floor area of the showroom is, therefore, completely flexible with regards to the installation or removal of displays, as it is possible to pick up an electrical outlet for telephones or mains voltage supply within 8 in. of a display centre without affecting any other display in the showroom.

As low levels of general illumination are required for demonstrations of lighting fittings and TV receivers, all showroom windows are screened by push-button controlled venetian blinds. In 28 ft. spans (the width of the windows), these are said to be the largest electrically-operated blinds ever made. The remote control is arranged so that, by pushing a button, entire groups of blinds will lower or raise themselves, maintaining a horizontal level at all times, while pressure on another push button causes the slats of the blinds to tilt slowly to any desired angle. The control system is arranged so that, if any attempt is made to raise the blinds while they are tilted, they will automatically straighten themselves out before rising.

A small lecture theatre seating 50 is provided at the ground floor level of the showroom for demonstrations. This theatre is arranged with four tiered rows of seats in a curve facing the dais and screen. In the ceiling directly in front of the screen are facilities for the suspension and electrical connection of demonstration equipment. The lighting of the theatre is by 2-ft. 40-watt fluorescent lamps housed in slots in the wooden ceiling, these lamps being on electronic dimmer circuits. The dimmer controls (and other controls) are conveniently placed for operation by the lecturer.

The theatre can be cut off from the remainder of the showroom by electrically operated venetian blinds, push-button controlled. A separate control operates the tilt of the slats which, being white on one side and black on the other, can provide a black or white screen as desired.

In the Ferguson section of the showroom there is a circular room, 16 ft. in diameter, in which 14 radio or television sets can be displayed. The sets are installed around the perimeter of the room, while the central area, on which seats are placed, can rotate so that dealers (for whom the room is intended) can study each set in turn.

The main display of Atlas lighting equipment is in the northern half of the main first floor showroom, where every type and size of unit in the Atlas range is on display, including Atlas street lighting lanterns arranged on stainless-steel standards with the lanterns at eye level for inspection.

Most of the fluorescent fittings are housed in a coffered ceiling. By removing a telephone type dial from the wall and dialling the appropriate numbers, any of these fittings can be lowered into view, whereupon they automatically light up. By dialling a special number the fittings return to their concealed positions. This arrangement avoids the unsightliness associated with many lighting showrooms which are festooned with fittings and cable.

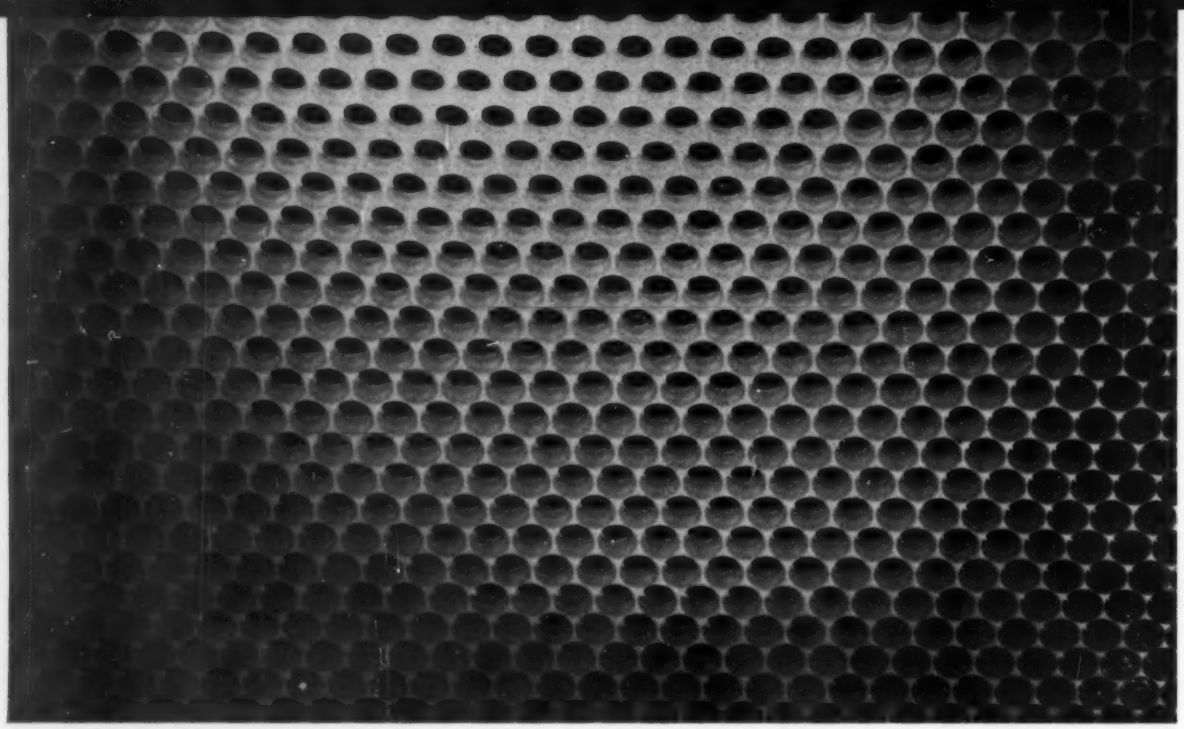
Fittings are counter-balanced in pairs, each pair being operated by a 1 h.p. single-phase reduction-geared motor connected by chain drive to the lifting and lowering mechanism. Relays are incorporated in each individual lift assembly.

In addition to the displays of lighting equipment, the showroom includes several exhibits illustrating principles of good lighting practice. These exhibits include a full-scale shop window in the first floor showroom, in which the effects of directional and uniformly diffused lighting can be demonstrated. A small colour comparator unit (and two rooms settings for the same purpose) is also provided, though a larger colour comparison section is to be built in the basement showroom area when this is completed.

High-frequency lighting in basement garage. The fittings have large, flat plastic diffusers and, although the effect is not revealed by this photograph, tend to create an illusion of a suspended ceiling, so that the true ceiling and the service pipes fixed to it are overlooked.

The Shape of Things to Come

This night picture of the Shell building now under construction on the South Bank in London is a reminder of the vast amount of building work which is going on all over the country and on which at this time of year progress is so largely dependent on artificial lighting. The lit-up skeletons of the Shell and other buildings make an impressive, fascinating and exciting sight—but as far as the lighting engineer is concerned they are also a reminder of the crude temporary lighting that is provided on such sites where work has its dangers at the best of times. Before J. Gordon Scott drew our attention to this aspect of lighting in his paper to the IES a year or so ago no-one seems to have given much thought to the temporary lighting of building sites and constructional works, but as a direct result of the interest shown in that paper the IES Technical Committee is now preparing a Technical Report on the subject. A good deal of work has gone into this Report and every assistance has been given by the building industry. We understand that the Report is not likely to be available for a few months.



Above, close up of "Circlgrid" louvered panel, showing arrangement of cells.

Luminous Ceilings Reviewed

By R. L. C. Tate (of Harris and Sheldon [Electrical] Ltd.)

PERHAPS the most spectacular advance in lighting practice over the last few years has been the development of the luminous ceiling as a normal method of lighting large offices, conference rooms and showrooms. The idea of the luminous ceiling is by no means new: the old chamber of the House of Commons, built in the middle of the last century and destroyed by enemy action, had a large glass laylight, originally lit by gas, which covered about a third of the ceiling, while many theatres, cinemas and hotel lounges in the '30s had glass laylights concealing tungsten filament lamps. It is only since fluorescent lamps became a common illuminant for commercial buildings, however, that the luminous ceiling has advanced from its former position as a costly treatment suitable for use only where the need for a particular decorative effect would justify the expense.

This advance has been much accelerated by the availability of numerous prefabricated unit ceilings making use of various types of diffuser and, sometimes, incorporating the lighting equipment in the supporting framework. The purpose of this article is to review the proprietary systems currently produced in the UK and the United States; to give information as to methods of installation and maintenance; and to attempt to collate design data derived from various sources.

Luminous ceilings can be divided into several categories according to the type of diffuser used, the material of which it is made or the arrangement of the lamps and reflectors above it. The most obvious division, however, is between those ceilings consisting of metal or plastic louvers and those in which the diffusing medium is a plastic sheet or tile.

"Louverall" ceilings

Standard metal louvered ceilings using 2-in. square cells were developed some years ago by Crompton Parkinson Ltd. and by Thorn Electrical Industries Ltd., and examples may be seen in the British Railways offices in Lower Regent Street, London, S.W.1, and in the Design Centre, Haymarket. It is difficult, however, to align the rows of cells exactly and, in consequence, this type of ceiling has never become as popular as the standard polystyrene louvered ceiling. In the United States ceilings made from "Honey-lite" tiles (very small hexagonal aluminium cells in framed panels) have been developed, but this method of construction has not been adopted by any manufacturer in the UK and the writer has only once seen it used in Great Britain for small louvered areas on an exhibition stand.

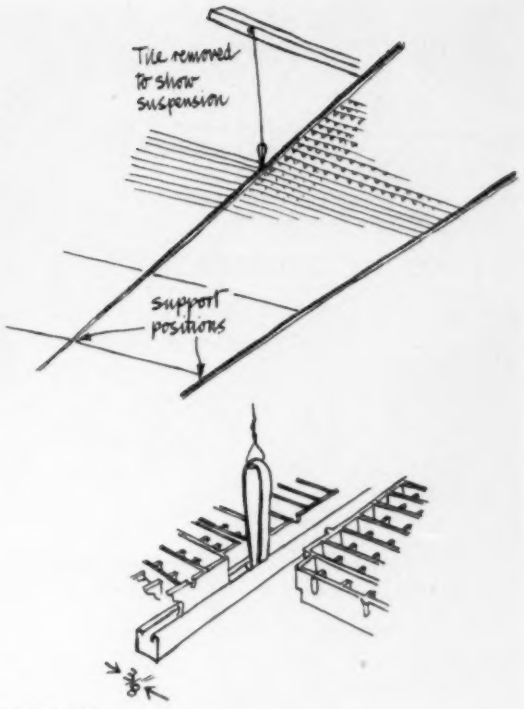
The pioneer polystyrene louvered ceiling was "Luve-tile," designed in Canada by J. A. Wilson Lighting and Display Ltd. and made and marketed in the UK by Harris and Sheldon Ltd. "Luve-tile" consists of a series of 1-ft. square tiles, made up from approximately 2-in. square cells which clip together to form the required area. Its chief advantage is that its system of suspension, described fully in an article in *Light and Lighting* for October, 1956, allows an unbroken area of luminous

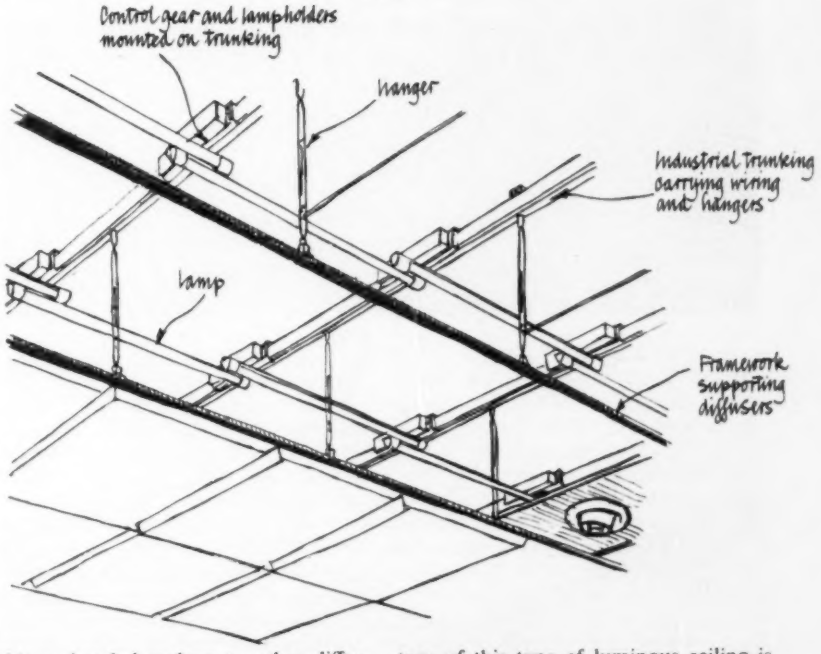
ceiling to be presented to the eye, a feature not possible with most other types of diffuser. "Luve-tile" has been used in many large installations, the most recent being the reconstructed Feeney Art Galleries in Birmingham.

Other types of polystyrene tile have been developed in more recent years. Elco Plastics have introduced a system based on a 1-ft. square tile which rests on a 'T' or 'Z'-shaped bar of the same material, and another in which approximately 1.4-in. square cells are arranged diagonally in 5½-in. square or 10⅞ x 9-in. units which can be cemented together to make larger areas.* Completely self-supporting panels can be made up to 6 ft. x 3 ft. in area, after which extra supporting members are required. Similar units are marketed by Ferry Custom and Courtney Pope (Electrical) Ltd. The latter company introduced recently an elegant small-cell louver of clear polystyrene with tapered fins. Marketed under the name of "Plane" prismatic louver and intended mainly for use in modular fittings, it could easily be used for luminous ceilings. In the USA similar louvers with an aluminium finish have been used successfully to reduce ceiling brightness in very high intensity installations.†

An attractive variation on the theme of polystyrene louvered tiles is "Paragrid-tile" in which the cells are only ½-in. square, while the louver fins are staggered to give a uni-directional effect. This is another Wilson-Harris and Sheldon product, though in this instance the tiles are supported on two sides only by narrow metal channels hung from the ceiling by piano wire. The tiles themselves are 1 ft. 4 in. square, a somewhat inconvenient dimension for ceilings designed on a 2-ft. module, though they can easily be cut to fit smaller or awkwardly shaped apertures. The fine detailing of cells and supporting members has made this system popular with architects and interior designers (see Fig.1).

Polystyrene has many advantages over other plastics, one of them being that it is easily injection-moulded, allowing precise dimensions to be adhered to in a cheap mass-produced article. Against the ease of manufacture, however, must be offset the heavy tooling cost. It has excellent light-transmitting and diffusing qualities; does not easily discolour; and is light in weight. On the other hand, it can support combustion and this property, among other things, has led makers to other diffusing materials, notably rigid pvc.





Right, Fig.1, "Paragrid-tile," views from above and below showing detail (an intersection of four tiles) of louver construction, aligning lugs and method of cutting away at corners to admit spring clip. Below, Fig.2, "Modulume" ceiling system.

Closed diffuser ceilings

The first closed-diffuser ceiling to be put on the market in the UK was the corrugated vinyl ceiling made by Lumenated Ceiling Ltd.* The obvious advantage of this type of luminous ceiling is that it completely screens the lamps from view. A disadvantage is that it is more difficult to clean and must be cleaned more frequently than a louvered ceiling. The long rolls of corrugated plastic are rather easily damaged at the edges and, unless carefuly handled, can become very shabby.

A variation of this ceiling is mar-

* A similar type of tile with ¼in. cells has recently been added to this range.

† See "Transatlantic Sketchbook", *Light and Lighting*, July, 1959.

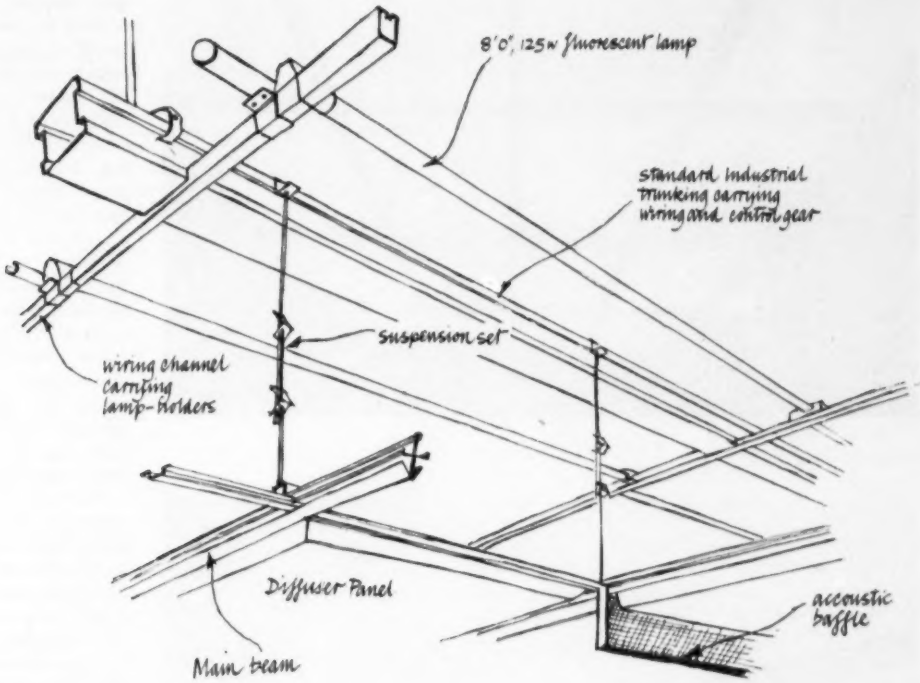
* Described in detail in "Lighting in Service Ceilings", *Light and Lighting*, October, 1956.

keted by Courtney, Pope (Electrical) Ltd. under the name of "Glolite". With this ceiling the supporting channels are of rectangular cross-section and provision is made for cross-members to be added if desired.

Lumenated Ceilings have introduced recently another ceiling, which they call "Lumenator," in which 2 ft. square pans are suspended from the ceiling on an extruded aluminimum track; in this, as in other similar systems, the vinyl pans can be moulded in a number of designs. It is assumed that these ceilings would be suspended below a white-painted "plenum", in which lamps would be mounted at the appropriate intervals, usually on standard batten fittings but, if necessary, fixed directly to the ceiling by "Terry" clips. Most manufacturers recommend suitable spacings and mounting-height ratios and some publish coefficients of utilisation, but the lighting method is not related mechanically to what goes on below the ceiling.

Recently, two manufacturers—Crompton Parkinson and Thorn Electrical—have broken away from this tradition by introducing systems in which the supporting framework of the ceiling panels form part of a channel system carrying lamps and wiring. The Atlas "Sylvalume" system uses the 8-ft. 125-watt lamp as its basic unit and the Crompton "Modulume" the 5-ft. 80-watt lamp. Both systems use 3-ft. square polyvinyl "tiles." The "Modulume" ceiling is also capable of accommodating strip diffusers of corrugated vinyl and metal pans housing one or more tungsten filament lamps in swivelling eyeball mountings (see Fig.2). The "Sylvalume" has provision for acoustic baffles, to be hung from the underside of the metal supporting grid, which can act, to some degree, as louvers, to reduce the apparent brightness of the ceiling at shallow angles of view (see Fig.3). Both systems use metal trunking to carry wiring, lampholders and control-gear, and to anchor the hangers or straps which support the luminous ceiling below. With the "Sylvalume" system standard industrial trunking is used to carry control gear, wiring and suspension hangers, and 1¼-

Top, interesting use of luminous ceiling panels alternating with louvers to admit natural daylight and screen fluorescent lamps in drawing office of Bowater Paper Mills. (Lumenated Ceilings Ltd.) Left, "Isora" ceiling in restaurant. The flat diffusers have a neat appearance but care must be taken to avoid the positions of the lamps being obvious. (S.F.I.M. (Great Britain) Ltd.)



Right, Fig.3, "Sylvalume" ceiling system.

in. square, open-topped box-channel is fixed at right angles at 8 ft. centres to its underside to carry the lampholders. With the "Modulume" system the trunking contains only the wiring—the control gear, lampholders and hangers being mounted outside it, while the trunking runs themselves are at 5-ft. centres.

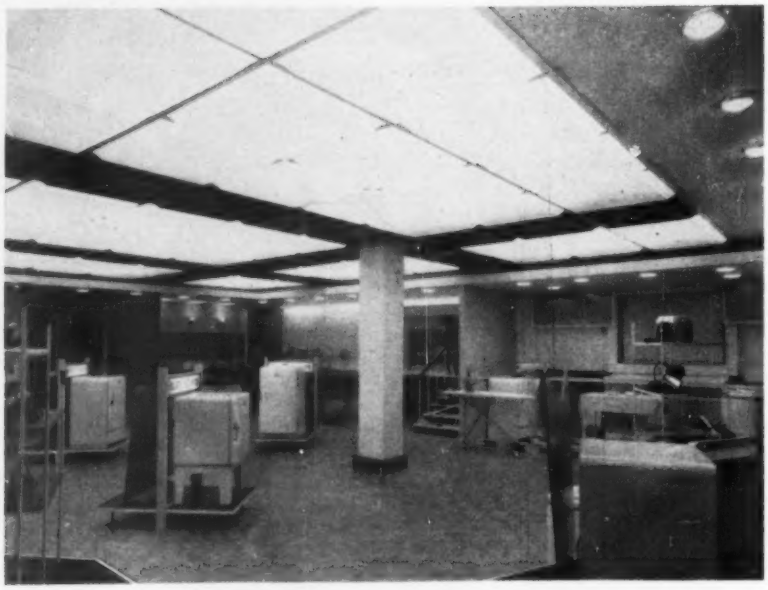
These systems have the advantage of being virtualy self-contained, requiring only one set of fixing holes for the whole lighting system, though they suffer from the minor disadvantage that they cannot be made to fit an irregularly shaped ceiling. If the panels are simply cut to shape a somewhat unfortunate effect may result (see Fig.4), and it is preferable to use infill panels between the squared-up luminous part of the ceiling and the surround walls.

A system now available in the United States and Canada (where it originated) goes one step further by not only relating the panel to the supporting members of the lamps and gear, but making each panel an independent unit, wita its own lamps and reflector. In this system the panel forms the lower limb of a sealed polyvinyl "bubble", of which the sides (of opaque white vinyl) are roughly parabolic in cross-section, while the top, which is transparent, is indented. This part of the bubble is held firmly against the underside of a normal metal reflector, housing one, two, or three fluorescent lamps, the white sides of the bubble acting as a further reflector. The metal ceiling grille, against which the bubbles are held by powerful springs, can be made to house air-conditioning ducts and sprinklers (see Fig.5). High efficiencies are claimed for this ceiling by the manufacturers, Lighting Materials Ltd., of Winnipeg, who say also that maintenance is extraordinarily simple. The prime cost of the installation is, however, rather high. In a similar American ceiling, clear vinyl sheets are laid over the diffusing pans, so that dirt or dead insects which collect in the plenum are not visbile from below, but in this instance the lighting equipment is mounted on the ceiling in the usual manner, and the upper sheet of plastic is not attached to the lower. Neither of these ceilings is at present available in the UK, however, and both are heavily protected by patents.

Four further types of ceiling—two available in the UK and two available in America—are the "Plasmatic", the "Isora", the "Infinilite" and "Circlgrid" systems. "Plasmatic" diffusers are extruded opal polystyrene panels, made to interlock along their longer sides and supported at up to 4-ft. centres by a framework of extruded polystyrene. The tiles are intended primarily for luminous areas in modular ceilings but can be built up into complete luminous ceilings if required. It is recommended that fluorescent lamps should be mounted parallel with the long edge of the diffuser panels and, where possible, above the joints. These panels, made by Elco Plastics Ltd., are of neat appearance and are more rigid than most types of luminous ceiling panel (see Fig.6).

The "Isora" ceiling, made in the UK by SFIM (Great Britain) Ltd., was designed in France. It is unique in that it uses panels of flexible pvc stretched over a mild-steel frame. The panels are extremely tough and, though they will stretch, they return quickly to their former shape. They are supported on a light but strong mild-steel framework which, if required, can be welded into position (see Fig.7). The light transmission of these panels is said to be 70-88 per cent, though their diffusing properties are poor: the position of the lamps is readily seen from below and the system is not suitable, therefore, for high-quality installations. In fact, the "Isora" ceiling was originally made as a translucent heat insulating system for installation below the large glass roofs of single-storey factories. High light transmission was clearly more important than good diffusion, and the material is less effective in wholly artificial lighting conditions. Diffusion can be improved by mounting the lamps above the dividing bars instead of in the centre of the panels.

The "Infinilite" and "Circlgrid" systems are unusual in that they both



make use of circular louver cells instead of rectangular ones, while "Circlgrid" departs from normal practice still further by being made of rigid pvc instead of polystyrene. The method of suspension of the "Infinilite" panel is of interest: Instead of a metal grid, clear plastic supporting clips are inserted in the centre of each 24 x 25-in. tile, the tiles being locked together by clear plastic connectors at the sides and halved joints at the ends. Thus a completely unbroken area of luminous ceiling is seen and the makers claim that the absence of a rectangular grid allows the tiles to be cut to suit a room of almost any shape. The profile of the louver cells themselves is also of interest, since they taper inwards to the centre-line, where a projecting ring is designed to throw a shadow on to the lower half of the cell thus reducing surface brightness (see Fig.8).

"Circlgrid" cells are smaller than those of the "Infinilite" ceiling, being only ½-in. in diameter, but their unusual construction results in a similar profile in each individual cell. The 2-ft. square tile is made from three sheets of material, the upper and lower vacuum-formed, with the middle one sandwiched between. The surface of the outer sheets consists of a large number of circular depressions, which are sealed together and pierced to form a series of circular louvers in a light yet surprisingly rigid tile. The tiles are supported on a slender framework of extruded aluminium sections suspended by piano wires.

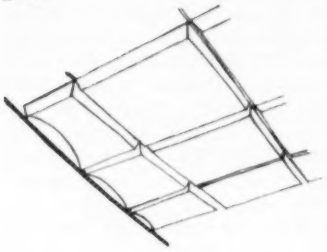
"Infinilite" is produced by Integrated Ceilings Inc., of Los Angeles, while "Circlgrid" was developed in Canada and the USA by Wilsons of Toronto. Both systems are claimed to combine the advantages of the louverall and diffusing types of ceiling.

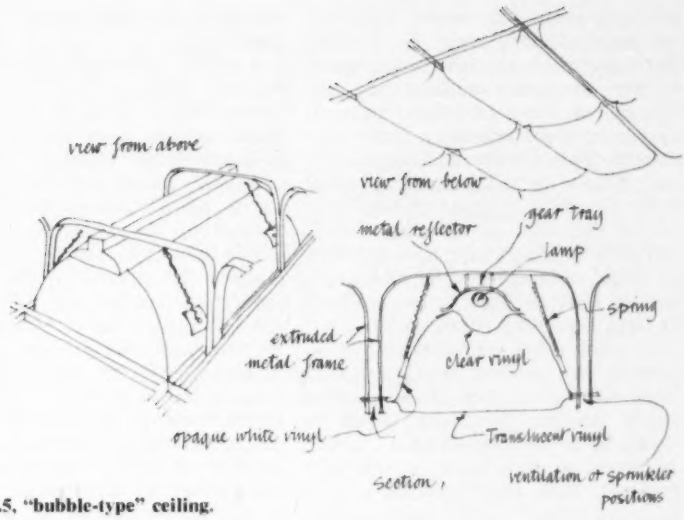
Designing luminous ceilings

Given favourable conditions, very high efficiencies can be obtained using luminous ceilings and, in the USA, coefficients of utilisation as high as 0.86 have been obtained. Such figures are exceptional, however, and for most

Top, "Glolite" luminous ceiling: note depth of supporting members. (Courtney, Pope (Electrical) Ltd. Centre, "Modulume" ceiling at Morphy Richards' showroom in Conduit Street, London, W.1: note use of black vinyl pans to break up luminous area. (Crompton Parkinson Ltd.) Bottom, demonstration installation of Harris and Sheldon's "Paragrid-tile," showing ease with which panels can be removed.

Below, Fig.4, diagram showing the slightly "accidental" appearance which results when dished pvc tiles are cut to fit a wall that is not parallel with the main supporting grid.





Right, Fig.5, "bubble-type" ceiling.

practical purposes the figures published by the British Lighting Council can be used with confidence. Two manufacturers publish figures based on American data, and in both instance the size and shape of the ceiling cavity is taken into account. It is obvious that the larger the area of the ceiling the more efficient the installation, and these companies make use of the formula $\frac{d\,(l+w)}{2lw}$ to produce a "cavity factor" where d = depth, l = length and w = the width of the cavity. The factors range from 0 to 1, the latter being the condition where the cavity is cubical, the former where it is of infinite length and width. The BLC figures are based on a cavity proportion of 3:1, i.e. the height must never be more than a third of the width. This gives a cavity factor of 0.3, and it would appear that for every step up or down from this about 3 per cent should be added or subtracted from the BLC coefficients of utilisation.

Room factors can also be calculated with a similar formula and, at first glance, this method may appear more accurate than the room indices given in the BLC handbook, but when it is realised that a room factor of 0 can be achieved only when l and w are equal to infinity, while the room factors of 0.1 and 0.2 refer to cubical rooms and those that are twice the height of their width and breadth, it will be seen that the extra figures are of little more than academic interest and are valuable mainly as a means of giving an impression of remarkably high efficiency for the products concerned.

For plastic louvered ceilings, however, the BLC figures, based on the use of metal louvers, are a little pessimistic, and the accompanying table may prove useful when calculating illumination values.*

Reflection Factor

Room Index	Ceilings	75%		50%	
	Walls	50%	30%	50%	30%
		Coefficients of Utilisation			
A		0.53	0.51	0.52	0.49
B		0.52	0.50	0.50	0.47
C		0.49	0.47	0.47	0.44
D		0.48	0.45	0.46	0.43
E		0.46	0.43	0.43	0.40
F		0.43	0.40	0.40	0.37
G		0.40	0.37	0.37	0.34
H		0.37	0.34	0.34	0.31
I		0.35	0.32	0.32	0.29
J		0.32	0.29	0.29	0.26

It will be noted that walls with a reflection factor of at least 30 per cent are assumed. Where dark wallpapers are used, from 4 to 5 per cent must be deducted from these figures.

Whatever system of calculation is employed, however, it is essential to obey the following rules if the best results are to be obtained:—

(1) *The cavity or the "plenum" should be free from obstructions.*

Subsidiary beams, pipes and ventilation ducts may cast shadows on the diffusing medium as well as reducing the total efficiency of the installation. Where structural beams break up the plenum cavity and especially where they are close to the diffusing medium, they are liable to cast heavy shadows and the designer must consider whether it is better to divide the luminous ceiling into areas bounded by the beams themselves.

(2) *The inside of the cavity must be kept white.* This is essential. A dark cavity can reduce the efficiency of the installation by over 60 per cent. Where a dark cavity is unavoidable (such as under a glazed roof-light) industrial reflectors may be used to direct the light down on to the diffusing medium, but this is always less efficient than using bare lamps in a white cavity.

(3) *The cavity should be as shallow as possible.* Constructional difficulties and considerations of current loading will determine this, but the nearer the formula $\frac{d\,(w+l)}{2\,wl}$ is to zero the more efficient will be the installation.

(4) *Above diffusing panels and metal louvers, the spacing/mounting height ratio should not exceed* $1\frac{1}{2}$ *to* 1. This may be increased to 2:1 above plastic louvers. Neglect of this rule will result in uneven "flashing" of the ceiling panels. In addition, it is recommended that the average reflection-factor of walls and floor should not fall below 50 and 30 per cent respectively.

Fire precautions and sprinkler systems

Some difficulty has been experienced by architects and lighting designers because of the varied requirements of local authorities where fire risks are concerned. Except in the LCC area, fire brigades have no statutory right to insist on the provision of sprinkler systems, but there is a growing tendency toward such regulation, and a degree of control is already exercised by the fire brigades of Liverpool and Manchester. The London regulations

* Taken from figures published by J. A. Wilson of Toronto, referring to "Paragrid-tile". Some types of plastic ceiling may have slightly lower coefficients of utilisation than those shown.

are very strict and, where sprinklers are required, they must be installed above and below any false ceiling which is not completely sealed and constructed of non-combustible material. Sprinklers are compulsory under Section 20 of the London Building Acts in any factory or warehouse exceeding 2,500 cu. ft. and, under Section 21A, in the basement or sub-basement of any such building which exceeds 100 ft. in height, irrespective of its cubic capacity, or 80 ft. in height, where is covers an area exceeding 10,000 sq. ft.

In other cities, sprinklers may occasionally be installed above areas of louvered ceiling, but there is some doubt whether permission to do so would be given where there is a closed false ceiling. Tests made in America*, however, show that sprinklers can be installed safely above vinyl ceilings, and will operate just as readily as if they are mounted below them. In the event of fire the pvc melts and collapses through the metal supporting grille and the large area of soft pvc helps to smother the fire. Polystyrene does not readily catch light, but when it burns it emits a thick, black smoke with a characteristic smell, rather like candle grease.

It will be appreciated from the above that no standard form of luminous ceiling entirely meets the LCC requirements, as even those that are made of non-combustible materials cannot be completely sealed, and this limits their use to small buildings which are not covered by the regulations. In larger installations it is clearly necessary to integrate the sprinkler system with the supporting members of the luminous ceiling†, though with a louvered ceiling with large cells sprinkler heads may be dropped through the centres of the tiles. In buildings subject to the regulations, however, it is not usually difficult to arrange for special supporting members along the rows of sprinklers, though such an arrangement is bound to add to the cost of the installation as well as altering its appearance.

Costs

Details of the construction and installation of various types of luminous ceiling can be obtained from manufacturers but it is not always easy to obtain an accurate idea of costs, as few manufacturers will quote on a square foot basis, though they will give a price for a complete ceiling. Costs per square foot vary from about 6s. to 12s. (list) for the false ceiling alone, but with those ceilings of which the lighting is an integral part the cost of the ceiling cannot be easily separated from that of the supporting members for the lamps and control gear.

Heating and ventilating

It is obvious that luminous ceilings of the types described above preclude the use of heated ceiling panels, unless the latter are arranged in solid areas between the luminous parts of the ceiling. Air conditioning equipment can, however, be used easily in conjunction with them, although it is recommended that such equipment should blow clean air into the plenum rather than suck dirty air into it from the room below. An alternative is to arrange for air ducts to occur in solid infills at the edges of a ceiling or between the luminous areas, though if this is done care must be taken to direct the flow of air away from the tiles, otherwise, no matter what plastic they are made from, they will soon collect a static charge and become correspondingly dirty.

Maintenance

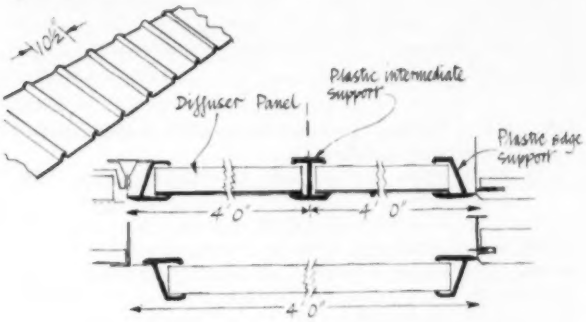
Whatever type of luminous ceiling has been installed, it will soon become unsightly if it is not regularly cleaned. The period of maintenance will naturally vary according to the locality, but, other things being equal, a louvered ceiling will not normally require such frequent cleaning as one using pan

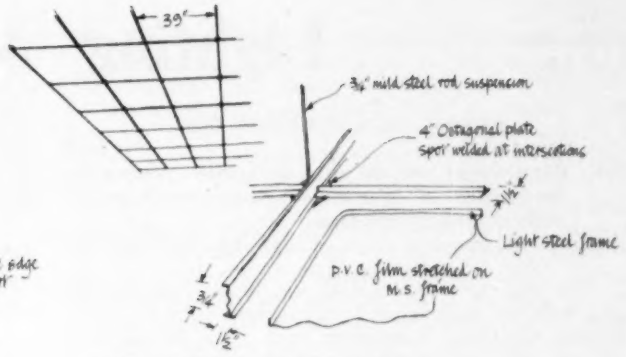
* See "Time versus Luminous Ceilings" by Domina E. Spencer and Leonard F. Martin, *Illuminating Engineering*, September, 1952.

† There is no standard British suspension which allows for this, although two American systems—those of Lighting Materials Ltd. and Westinghouse—do so.

Below, "Sylvalume" ceiling installation on an exhibition stand. Deep concave pans have been used to give the ceiling a "textured" effect. (Thorn Electrical Industries Ltd.)

Below, Fig.6, "Plasmatic" system: sections through flush-mounted and dropped-panel installations, and sketch (from above) of overlapping joints of panels.

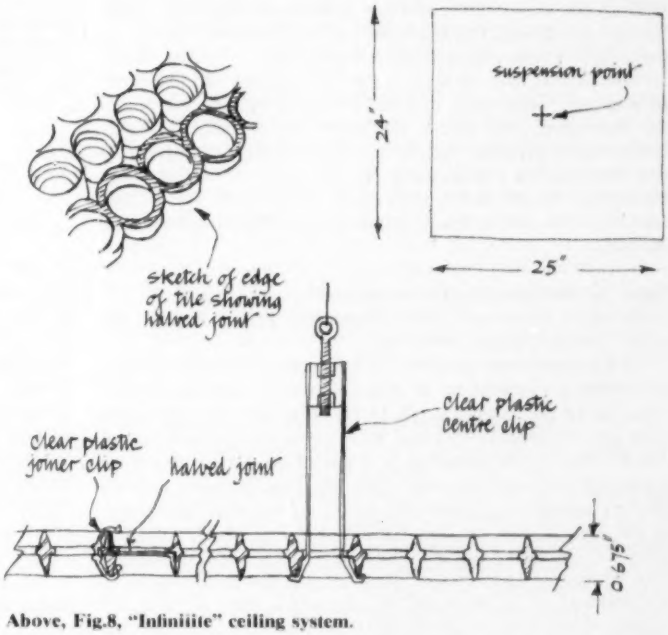



39"
3/4" mild steel rod suspension
4" Octagonal plate spot welded at intersections
Light steel frame
P.V.C. film stretched on M.S. frame

Above, Fig.7, "Isora" system: the part detail of panel and suspension grid is a view from above.

diffusers, as some dirt will fall through the tiles instead of lodging on top of them. In this respect, however, the only complete answer is to use a double tile of the type described earlier in this article.

Much has been said about the difficulty of maintaining luminous ceiling panels but, while it is true that if they are badly looked after they soon become untidy, the cleaning of plastic panels or louvers is by no means such an arduous task as many people think. The important things to remember are that they must first be cleaned in a suitable detergent and allowed to dry, and then dipped in a de-staticising solution and allowed to drip dry. The procedure is much the same for both flat and louvered panels, though with the latter the panels should be swished about in the water so that the cells will act as a sponge and assist in removing dirt from the surfaces. The laborious exploration of each cell with a bottle-brush is neither necessary nor desirable. It is important that the tiles should be allowed to drip-dry: on no account should they be polished as this will immediately put a static charge on them which will collect dust in a very short time. Handling of the tiles should also be reduced to a minimum, and it is suggested that they should be handled by men wearing white cotton gloves. For large installations, a system of portable baths and drying racks is desirable, and it is suggested that a dozen or so spare tiles be kept in reserve to replace those removed for cleaning.



Above, Fig.8, "Infiniiite" ceiling system.

Conclusion

When and where it is desirable to use luminous ceilings, their effect on modelling and the propriety of lighting only from above are, it is felt, beyond the scope of this article, which is merely concerned with their mechanics, nor can the relative advantages of a completely luminous ceiling or one broken up into light and dark areas be discussed here. It will almost certainly be remarked that there are other types of luminous ceiling than those described above, but most of them are specially made or are part of the structure of the building they serve, and are consequently outside the limits which have been set. Such a one is the system of cold cathode lamps in very narrow channels covering the ceiling of Parsons factory at Newcastle, which serves also to provide radiant heating for the rooms it lights, and the very high intensity ceiling in the workshop at NELA Park, made by covering the whole area with specially designed aluminium reflectors.*

Rotterdam ceilings and methods of supporting lighting fittings in a metal or plaster ceiling on a modular grid have also been excluded—the first because they are not luminous over the greater part of their area; the second because they are primarily false ceilings and only secondarily concerned with lighting. It is hoped, however, that enough information has been collected to assist architects and lighting engineers in selecting the most suitable type of luminous ceiling for their purpose, assuming that they have already decided to use this type of lighting.

* See "Transatlantic Sketchbook", *Light and Lighting*, July, 1959.

Lighting Abstracts

OPTICS AND PHOTOMETRY

612.843.6

744. Development and use of a quantitative method for specification of interior illumination levels on the basis of performance data.

H. R. BLACKWELL, *Illum. Engng*, **54**, 317-353 (*June*, 1959).

The visual performance data used by the American IES as a basis for their recent (1958) upward trend in recommended minimum illumination levels were derived from an eight-year programme of research. In describing each phase of this programme, the act of seeing is first analysed. For the derivation of laboratory data on threshold perception, the act was reduced to its most elementary form—the seeing of a simple test object. Other experiments, including the use of a Field Task Simulator, enabled a "field factor" to be determined relating the laboratory data to conditions more comparable with practice. A Visual Task Evaluator was also used to assess the lighting requirements of practical visual tasks in terms of the lighting requirements for the simple test object. A sample of 56 different visual tasks was studied by means of the Evaluator to determine the illumination requirement for 99 per cent accuracy of perception of the tasks, allowances being made for a field factor of 15 and a visual capacity of 5 assimilations per second. P. P.

745. A discomfort glare evaluator. 612.843.367

S. K. GUTH and J. F. MCNELIS, *Illum. Engng*, **54**, 398-403 (*June*, 1959).

A Discomfort Glare Evaluator has been devised in order to compare assessments of glare in actual lighting installations using the American BCD ("border-line between comfort and discomfort") rating with laboratory data. In using the Evaluator, the observer is required to equate the glare sensation produced by the given lighting installation with that produced by a small test source of variable luminance, a movable shield on the Evaluator being in the "down" position, so screening the luminaires from view, while the test source is illuminated. Results are given of the BCD evaluations of a team of 50 observers, and of the test source luminances required by these observers to equate the glare experienced in each of 5 different lighting installations. A comparison is made with Fry's (1956) proposal for computing discomfort ratings in terms of glare source solid angles. P. P.

LIGHTING

628.972

746. The lighting of Gloucester Cathedral by the "Designed Appearance" method.

J. M. WALDRAM, *Trans. Illum. Engng. Soc.* (*London*), **24**, 85-100 (*No.* 2, 1959).

In applying the author's "Designed Appearance" method to the re-lighting of Gloucester Cathedral, photographs, plans and guide-books were first studied. These enabled a preliminary sketch of the proposed appearance of the lighting to be prepared. After minor modifications resulting from visits to the Cathedral, an apparent brightness pattern could be specified from which the requisite direct illuminations could be calculated. This enabled the numbers and types of fittings and their approximate locations to be determined, and hence a lighting specification to be drawn up at an early stage. The achievement of the final lighting effect, using in many cases a specially designed adjustable projector, is described with numerous photographs and sketches. P. P.

628.93

747. Aid to finding the most economical cleaning period for lighting installations.

D. MATANOVIC, *Lichttechnik*, **11**, 382-384 (*July*, 1959). *In German.*

The reduction of illumination in a lighting system due to dirt accumulation, etc., may be represented by $(1—e—t/a)$ where t is the time since the last cleaning and a is a constant which depends on the characteristics of the installation and its surroundings. If the efficiency of the system when clean, the cost of power and the cost of a single cleaning are all known, the most economical period between cleanings can be calculated. As the mathematical equation to be solved involves transcendentals, diagrams are given in the paper to enable the result to be obtained easily. J. W. T. W.

628.93

748. Study of the illumination from an inclined rectangular diffuse radiator.

J. SCHLAGER, *Lichttechnik*, **11**, 380-382 (*July*, 1959). *In German.*

The formulae for the illumination at a point opposite one corner of a rectangular diffuser when the illuminated surface is either parallel or perpendicular to the diffuser are well known. The author has treated the general case when the planes containing the illuminated surface and the diffuser respectively are inclined at any given angle. If the geometry is expressed in terms of linear dimensions the formula is very unwieldy, but if angles are used it is much neater. The author shows how the formula may be used to calculate, say, the illumination at a point on a horizontal plane due to the light from a rectangular window in a sloping roof, assuming a uniform sky luminance. J. W. T. W.

621.327.43

749. Maintenance factors and features of industrial fluorescent luminaires.

G. J. TAYLOR and R. D. BRADLEY, *Illum. Engng*, **54**, 389-396 (*June*, 1959).

A 5,000 sq. ft. test area in a factory has been used to obtain lumen maintenance data from fluorescent luminaires with different proportions of upward and downward light. Illumination readings obtained over a 30-month period have enabled graphs to be plotted showing the percentage loss in illumination with time resulting from lamp depreciation, dirt and dust accumulation and lamp mortality. Two group-relamping schedules have been assumed in order to assess maintenance factors for the different luminaires. These maintenance factors have then been used in a study of the relative economies of the different luminaires. P. P.

628.972

750. "It seems to me"; A survey of opinion on future trends in lighting.

Illum. Engng, **54**, 374-381 (*June*, 1959).

Arising from the recent (1958) introduction by the American IES of increased recommended illumination levels, comments were invited from the US lighting industry. These

dealt chiefly with the achievement of quality in high-level lighting and the dissipation of generated heat. Sources of large area, and consequently relatively low luminance, would most likely be used, with increased attention to shielding and reflected glare. The heat generated from fluorescent lighting at 150 lm/ft² or more would be sufficient for much winter-time warming of buildings. At higher levels, approaching those obtainable in daylight outdoors, air movement, similar to that experienced outdoors, would need to be artificially introduced. P. P.

628.972

751. Recommended levels in current practice: Industry, offices, schools.

Illum. Engng, **54**, 359-371 (*June*, 1959).

Although the higher recommended minimum illumination levels of the American IES have been current since August, 1958, many lighting installations in US factories, offices and schools were achieving these levels before the recommendations were published. This is demonstrated in a profusely illustrated article in which extracts from the new recommendations are reproduced along with photographs and brief photometric details of a wide variety of these particular buildings. P. P.

628.98

752. Lighting needs of persons when at work and when relaxing.

W. ARNDT and E. A. VOIT, *Lichttechnik*, **11**, 423-426 (*Aug.*, 1959). *In German.*

A number of experimental rooms of different proportions were provided with lighting similar in distribution to that in a room with side windows. Different schemes of wall decoration and different lighting levels were used in one room. A large number of observers were asked to indicate their choice of positions for working and for relaxing. These choices, both as regards situation in the room and direction in which the observer preferred to face, are shown in a series of diagrams. The general conclusions, most of them those that would be expected on general grounds, are summarised as far as possible. J. W. T. W.

753. Recommended levels, interior and exterior. 628.972

Illum. Engng, **54**, 428-433 (*July*, 1959).

Continuing a series of articles (Abs. 751), photographs and technical data relating to a miscellaneous selection of indoor and outdoor lighting installations (banks, hospitals, service stations, etc.) are reproduced along with the new recommended levels. P. P.

621.327.43

754. A new simple approach to group re-lamping of fluorescent lamps.

E. W. BEGGS, *Illum. Engng*, **54**, 434-439 (*July*, 1959).

Today's fluorescent lamps not only have better lumen maintenance and a longer life, but also have a reduced variation in life performance between individual lamps and groups of lamps. This means that although the lamps in a fluorescent lighting installation burn longer before failure, once they begin to fail they do so very much more rapidly. This gives added support to the policy of group re-lamping as a means of maintaining fluorescent lighting installations, such re-lamping being carried out every two years in most single-shift installations and every eighteen months in multi-shift installations, the re-lamping being effected simultaneously with routine cleaning of the luminaires. P. P.

628.972

755. Some possibilities for enrichment of luminous ceilings.

G KEPES, R. O. PREUSSER, D. E. SPENCER and L. F. MARTIN, *Illum. Engng*, **54**, 443-447 (*July*, 1959).

Present-day luminous ceilings make no attempt to exploit the inherent possibilities of transmitting light, with variety, through textured and patterned details in the diffusing medium. The authors review such possibilities from the stand-points of architectural, visual and structural criteria. The preservation of a 3:1 adaptation ratio for all lines of sight imposes limitations on the luminance range of individual elements of a textured luminous ceiling. Panels which are not perfectly diffusing enable the work at desk level to appear brighter than the ceiling (for normal viewing angles), but care must be taken to ensure that the transmittance of the diffusing material in a vertical direction is not so great as to introduce problems of reflected glare. P. P.

628.971.6

756. Calculation of the average illumination in a street lighting installation with fluorescent lamps.

B. STECK, *Lichttechnik*, **11**, 428-430 (*Aug.*, 1959). *In German.*

The German specification for street lighting specifies values of average illumination on the road surface. If the polar curve perpendicular to the axis is known for a fitting with tubular fluorescent lamps, and if the polar curve in a plane containing the axis is assumed to be represented by $I_\theta = I_o(\cos\theta + \cos^3\theta)$ the average illumination can be calculated for any given arrangement of the fittings on a particular street. The author gives worked examples to show how, for a particular fitting and street, the mounting height giving a specified average illumination can be found when the fittings are (a) longitudinal and horizontal, (b) transverse and horizontal and (c) transverse and inclined at 15°. J. W. T. W.

757. New applications of electroluminescence. 621.32

P. TOULON, *Bull. Soc. Franc. Elect.* (7th Series), **9**, 380-382 (*July*, 1959). *In French.*

Describes an arrangement of small electroluminescent elements arranged in a panel so that by lighting them in suitable combinations it is possible to form letters and figures. The selection of the appropriate elements can be carried out by switches operated by a typewriter keyboard. A memory device is described using a ferroelectric capacitor, the capacity of which varies with the applied voltage, which operates to unbalance a bridge when charged, and which can thereby retain the indication for periods up to half an hour. Colour changes are possible with certain luminescent materials by changing the frequency used. The order of frequency is 5000 cycles; the luminance is 90 ft-L giving a life of several thousand hours. J. M. W.

621.327

758. Some new technical aspects of electroluminescence.

G. DESTRIAU, *Bull. Soc. Franc. Elect.* (7th Series), **9**, 383-388 (*July*, 1959). *In French.*

Progress since 1952 is reviewed. The efficiency of electroluminescent devices has risen from 5 to 14 lm/W, and luminances have risen by a factor of 500; values of 3,000 ft-L are now possible, which is in excess of that of fluorescent tubes. Frequencies used lie between 500 and 1,000 cycles/sec. The emitted light exhibits a continuous component and a periodic component, the relative amounts of which vary with frequency. An electroluminescent device is described for amplifying radioscopic images by a factor of about 100. J. M. W.

IES Golden Jubilee

President's Reception, London County Hall

The final function of the IES Golden Jubilee activities in the London area took the form of a Reception at County Hall, Westminster Bridge, on Friday, 30th October which was attended by 450 members and guests. The official guests included the Chairman, Leader and senior officials of the London County Council, the Presidents of the IEE and of the RIBA and representatives of many other Institutions and Societies.

1 2 3 4 5 6 7

1, *The IES President and Mrs. Campbell;* **2**, *Mr. W. O. Hart (Clerk to the LCC), Miss Hart, Mr. S. Barton (Chairman of the LCC), Mr. A. G. Penny (Chairman IES Jubilee Committee), Mrs. W. S. Stiles, Dr. J. W. T. Walsh;* **3**, *Sir Willis Jackson (President, IEE), Lady Jackson, Mr. Basil Spence (President, RIBA), Mrs. Spence, Mrs. O. W. Humphreys, Mr. D. L. Tabraham, Mrs. Tabraham;* **4**, *Mr. J. Rawlinson (Chief Engineer, LCC), Dr. W. E. Harper, Mrs. Rawlinson, Mrs. Harper, Mrs. G. F. Cole, Mr. A. W. Gostt;* **5**, *Mr. G. F. Cole, Mrs. Penny, Mrs. Barton, Mr. S. Barton, Mr. A. G. Penny, Mr. O. W. Humphreys;* **6**, *Mr. J. Rawlinson, Sir Isaac Hayward (Leader of the LCC), the President;* **7**, *Mr. and Mrs. L. C. Penwill being received.*

Civic Reception, Council House, Birmingham

Left to right: Mr. H. G. Campbell, Mrs. Campbell, The Lord Mayor, The Lady Mayoress, Mrs. Yeates, Mr. J. R. Yeates, Birmingham Centre Chairman. At rear, Mr. C. Willdey, Hon. Secretary of the Birmingham Centre, and Mrs. Willdey.

The Lord Mayor of Birmingham, Alderman John H. Lewis, honoured the Birmingham Centre of the Society by holding a reception in the Banqueting Hall in the Council House on November 6 to celebrate the Golden Jubilee of the Society. The Lord Mayor and Lady Mayoress, with Mr. and Mrs. H. G. Campbell and Mr. and Mrs. J. R. Yeates welcomed members and guests of the Centre. Mr. Campbell, the President of the Society, was accompanied by past-presidents, Dr. W. E. Harper, Mr. J. G. Holmes, Mr. E. B. Sawyer and Mr. C. C. Smith, for his visit to Birmingham. The assembly danced from 8 p.m. until midnight in the flower-bedecked hall and enjoyed an excellent runnning buffet provided in the Drawing Room. The Feeney Art Gallery, adjoining the Council House, was thrown open for the occasion and a promenade to see some of our national art treasures was a most pleasant diversion. In a brief closing speech Alderman Lewis reminded the Society of his own link with their profession through his association with the gas industry, and his kind appreciation of the work and strength of the Society received ready response from Mr. Campbell and Mr. Yeates. This Civic honour to the Birmingham Centre is the culmination of a most successful and eventful year, during which the Centre itself, begun in 1938, attained its majority.

Forthcoming Events

CENTRES AND GROUPS

January 6

SWANSEA.—Chairman's Address, by J. R. Smith. At the Demonstration Theatre, The South Wales Electricity Board, The Kingsway, Swansea. 6.30 p.m.

January 7

CARDIFF.—Lighting in Moscow and Leningrad, by A. G. Penny.

NOTTINGHAM.—Stage Lighting, by E. E. Farraday.

January 11

SHEFFIELD.—Presidential Address, by H. G. Campbell. At the Grand Hotel, Sheffield. 6.30 p.m.

January 12

GLASGOW.—Modern Lighting Techniques, by M. J. Powley. Joint meeting with ASEE. At the Kenilworth Hotel, Queen Street, Glasgow. 8 p.m.

January 13

EDINBURGH.—Hospital Lighting, by G. R. N. Chalmers. At the YMCA Social Room, 14, South St. Andrew Street, Edinburgh. 6.15 p.m.

January 14

MANCHESTER.—Lighting as an Aid to Police and Photography, by Det. Sgt. H. Martin. At the Demonstration Theatre, Town Hall Extension, Manchester. 6 p.m.

January 15

BIRMINGHAM.—Annual Dinner. At the Queen's Hotel, Birmingham.

January 18

BATH AND BRISTOL.—Lighting and Other Things in Moscow and Leningrad, by A. G. Penny. At Gardiner, Sons & Co. Ltd., Broad Plain, Bristol.

January 19

HULL.—Lighting for Ships, by P. Chittenden. At the Lecture Theatre, Yorkshire Electricity Board, Ferensway, Hull. 6.30 p.m.

LIVERPOOL.—Lighting and Other Things in Moscow and Leningrad, by A. G. Penny. At the Merseyside and N. Wales Electricity Board Industrial Development Centre. 6 p.m.

NORTH LANCASHIRE.—Lighting of the Niagara Falls, by D. J. Reed. At the Demonstration Theatre, North Western Electricity Board, 19, Friargate, Preston. 7 p.m.

January 22

GLASGOW.—Luncheon Meeting. At the Bath Hotel, 152, Bath Street.

January 25

BIRMINGHAM.—Domestic Lighting, by D. W. Durrant. At Bennett Hall, YMCA, Snow Hill, Birmingham. 6 p.m. (This meeting is of interest to ladies who are invited to attend.)

LEEDS.—Some Recent Developments in Street Lighting, by N. Burgess. At The British Lighting Council, 24, Aire Street, Leeds, 1. 6.15 p.m.

LEICESTER.—Recent Developments in Light Sources, by D. H. Holloway. At the Demonstration Theatre, East Midlands Electricity Board, Charles Street, Leicester. 7 p.m.

January 29

NEWCASTLE-UPON-TYNE.—Annual Dinner and Dance. At the County Hotel, Neville Street.

Correspondence

Discomfort Glare Appraisals and Calculations

Sir,—With reference to Mr. Lowson's letter in your August/September issue, the main purpose of publishing the results of my comparison of discomfort glare appraisals and calculated values was to give a warning that misleading results could be obtained with the formulae considered in the article when they were applied to actual lighting installations. I agree with Mr. Lowson that the "impressive amount of laboratory work" has led to a fuller appreciation of the factors which affect discomfort glare: the impression could be obtained, however, that the final answer had been reached. In fact, workers in this field are agreed that further investigation is required, and one particular aspect of this work is the translation of laboratory data to actual installations.

A great deal of information can, however, be obtained from the existing formulae provided that their limitations are known and that the approach is a cautious one. Indeed, my company is using with much success the Harrison-Meaker Glare Factor System for the assessment of discomfort glare.

Mr. Lowson comments on the inclusion in the tests of reflectors which are open at the bottom and equipped with small high-brightness lamps: four of the test installations were of fittings of this type, *viz.*, A, B, G and H. We wished to cover as wide a range as possible of present-day installations in this country in our tests, and therefore had to include some of open reflectors because quite a high percentage are of this type, in particular for industrial interiors. In a conversation I had with Dr. Ward Harrison during the summer, he indicated that the formula he developed with Mr. Meaker did not apply to installations of fittings of this type. When these are excluded from this particular comparison of the appraisal and calculated values, the agreement is improved. I feel that this important limitation to a diffusing type of source, including fluorescent tubes, has perhaps not been emphasised enough in published work.

It is suggested that there are discrepancies between my calculated Harrison-Meaker Glare Factors and figures obtained from the tables published in the 1947 paper by Harrison and Meaker. In the cases where interpolation in the tables is valid, and when the complete data for the various factors are taken into consideration, reasonable agreement is obtained. I hope to issue soon the full details of each installation.

There is some criticism of the use of people who were not lighting engineers as part of the team of observers. Examination of the detailed results does not show any marked difference between the appraisals of this group of people and those of the more experienced lighting engineers.

Mr. Lowson fears that the results and conclusions of the test will discourage further work in this field. I do not think that this is happening and it was the very opposite of my intention. In this country, at any rate, more workers seem to be spending even more time on the problem, in particular the extension of the work to actual large-scale installations.

Finally, there is much admiration in this country for the new Australian artificial lighting code. In particular, the publication of detailed luminance limit tables, based on the Harrison-Meaker system, is a new approach on which we should all like to congratulate the authors.

E. ROWLANDS.

Wembley.

Personal

MR. D. I. CAMPBELL, B.Sc.Econ., formerly with the Lighting Division at the Head Office of Philips Electrical Ltd., has now been appointed a Lighting Division Representative of the South-East Region.

AEI Lamp and Lighting Co. Ltd. has appointed MR. J. J. BONAKER as Assistant Manager Export with his office at Melton Road, Leicester. Mr. Bonaker joined BTH in 1945 and in 1956 became head of the Lighting Export Department.

MR. MICHAEL FARR is to be Chief Information Officer of the Council of Industrial Design on January 1, 1960. Mr. Farr has been Editor of "Design" since 1952 and will succeed MR. J. NOEL WHITE, who becomes Deputy Director on the same date.

The General Electric Co. Ltd. announces the following appointments to its Board: MR. T. B. O. KERR, Director for Finance and Administration; MR. O. W. HUMPHREYS, Director for Research and Technical Development and MR. W. J. BIRD, Director for Sales and Marketing Development. Prior to these appointments Mr. Kerr was Company Secretary, Mr. Humphreys was Research Director and Mr. Bird was Home Sales Director.

MR. T. W. HEATHER, Assistant Managing Director of The General Electric Co. Ltd., retired at the end of October. He joined the Company in January, 1914, and became Assistant Manager of the publicity organisation. He was appointed Assistant Managing Director in 1957.

MR. WILLARD C. BROWN, manager of lighting education for the Large Lamp Department of the General Electric Co. of the USA, has been elected president of the United States National Committee of the CIE for the next four years.

Obituary

Lionel Smith

Lionel Smith, Commercial Director of The Benjamin Electric Ltd., died on October 28th at the age of 56. Mr. Smith entered the service of the Company in 1925 as Sales Engineer, later becoming Manager of the Sales Department, then Personal Assistant to the late Mr. Guy Campbell, and eventually was elected to the Board in 1938 as Commercial Director. He was a member of the ELFA Council. A keen yachtsman, being a member of both the Royal Thames Yacht Club, and the Royal Ocean Racing Club, he took part in many races.

Trade Literature

COURTNEY, POPE (ELECTRICAL) LTD., Amhurst Park Works, Tottenham, London, N.15.—Two new illustrated leaflets; one giving details and prices of the "Stripline" range and the other "Looking at Louvres." Both for commercial and industrial use.

FALK, STADELMANN & CO. LTD., 91, Farringdon Road, London, E.C.1.—Several new leaflets giving information and prices on the following: Fluorescent lighting fittings, consumers' control units, "Olympus" and the "Summit" ranges of lighting fittings.

ROTAFLEX (GREAT BRITAIN) LTD., 4, Conduit Street, London, W.1.—A booklet giving full details and prices of a new range of low cost fittings designed essentially for commercial and display purposes, including pendant, wall and ceiling fittings.

British Lighting Council

Bristol Offices

South West Regional premises of the British Lighting Council at West India House, 54, Baldwin Street, Bristol, were officially opened on November 24th by the Bristol

Mr. A. H. Clarke, Bristol City Architect with Mr. R. S. Hazell, BLC Regional Engineer and Mr. E. B. Sawyer, at the opening of the Bristol offices.

City Architect, Mr. A. H. Clarke. The chair at the opening ceremony was taken by Mr. W. J. Guscott of the South Western Electricity Board, who is chairman of the BLC South Western Regional Advisory Committee.

Publications

New publications by the BLC include the following: *Shop Lighting* (32 pp, price 1s 6d). Deals with the need, purpose and value of lighting in shops and reviews equipment now available for lighting windows and interiors.

Your Home Lighting (14 pp, no charge). A short guide to domestic lighting giving the basic framework within which the personal touch can find expression. A 'shopping guide' gives points to bear in mind when selecting the right lamp for the job.

Fluorescent Tubes and Circuits (32 pp, price 1s 6d). This gives a concise summary of the essential facts about tubes and circuits such as operating characteristics, light output, life, etc., with notes on colours, power factor corrections, radio interference, servicing and detection of faults. It includes both hot and cold cathode lamps.

Revised editions of previous publications include *Electric Lamps* (154 pp, price 10s 6d), *Interior Lighting Design* (76 pp, price 5s), and *Industrial Lighting* (72 pp, price 5s).

All the above publications are available from the BLC, 16-18, Lancaster Place, London, W.C.2, or from the BLC regional offices.

Situations

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LIGHTING FITTINGS REPRESENTATIVE required by a progressive decorative/commercial manufacturer, to cover wholesale/retail/contractors in the London area. Previous experience not necessary, but an advantage. An excellent position awaits the young man with personality and sales drive. Write in confidence, stating salary required, etc., to Ref. TD/S Box No. 614.

JUNIOR LIGHTING ENGINEERS required by West End Company of Illuminating Engineers specialising in Theatre, Television and other forms of lighting. Apply in writing, giving full details of age and experience, to Box No. 616.

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POSTSCRIPT By 'Lumeritas'

NOW that the subject of recommended levels of illumination is engaging the attention of code revisers on both sides of the Atlantic it is topical to comment on this important matter. Recommended levels have been raised several times within the past two or three decades and there are those who anticipate that further increases will be made from time to time before the summit is reached. There are also some people who are a little perplexed by such changes and whose views could be put thus:—"Surely mankind has been seeing things for long enough to have no uncertainty about how much light is needed for seeing them, so why can't levels of illumination now be recommended with a finality which will prevent lighting practice becoming out of date every few years?" One fairly obvious answer to this question is that we know that most visual capacities are at their best in good daylight and, since we know what "good daylight" amounts to in terms of lumens per square foot, final recommendations *can* be made now. Indeed, there

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Light and Lighting

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THERE are, of course, several reasons why recommended levels of illumination have been "on the up and up" in our time. Although the fact that vision is best in good daylight is not a twentieth century discovery, our knowledge of the way in which the different functional capacities comprising "vision" vary with the amount of illumination available has certainly been refined by the results of numerous comparatively recent researches. It is true to say that it is now possible to specify values of illumination for different degrees of visual efficiency with greater confidence than hitherto and, if "the general climate of opinion" or the "pressure of events" (e.g., the need for greater industrial efficiency) leads to the adoption of a higher visual performance criterion, recommended values of illumination must go higher too. But if there is nothing to be gained by exceeding sky-high values how far short of these can we fall without losing much? The answer is that the shortfall can be very considerable because all the scientifically determined curves representing the growth of visual performance evoked by the increase of illumination agree in one respect—their upward slope decreases progressively above a moderate value until it becomes no longer perceptible at bright sky values. This is true whether the visual performance considered is that of contrast detection—as studied by Blackwell and others, or that of acuity—as studied by Foxell and Stevens and others, or that of "output" in actual and in simulated industrial visual tasks—as studied by Weston and others. This general truth—that diminishing returns are got as we get into the upper reaches of the useful range of illumination values—means that every time the criterion for "code" illuminations is raised by a given and worthwhile step previously recommended values have to be multiplied by a larger factor.

IN the early days of lighting codes recommended illumination values were comparatively low for economic, technical and sociological reasons. In other words, high illuminations by artificial lighting were expensive, technically difficult to provide and not part of the then expected amenities of life. None of these reasons for meagre levels of illumination is now valid. High levels of illumination are generally easy to provide where they are advantageous, their cost, over limited areas, is not prohibitive, and generous conditions of lighting are, very properly, among the better living standards now looked for. Nevertheless, the acme of good vision which can be reached at good daylight levels of illumination is a good deal better than is needed for many common visual tasks. "Actually"—to quote an American dictum (Willard Allphin's)—"there are surprisingly few industrial tasks which require keen visual discrimination." So, it is for the relatively few highly critical visual tasks that further increases in recommended levels of illumination could best be justified, if there were no other equally practicable means capable of facilitating the performance of such tasks. Probably, however, this is likely to prove a subject for continuing "great argument about it and about."

A RECENT warning of possible power cuts in the London area, because of a threatened strike, led a BBC outside reporter to ask people in the street how they would help to reduce the load so as to lessen the risk of a temporary shut-down. The replies received were "illuminating." Almost all of them referred to abstention from the use of low consumption "appliances" such as lamps, electric shavers and hair driers, and only one mentioned doing without the electric fire. Doing without lighting was a first and common thought—usually because "if the 'tele' is on lighting isn't needed." I wonder whether people who are so ready to dispense with lighting first ever give themselves as much of it as can be got for less than the "tele's" power load?

MY last words in the present volume of this journal have nothing to do with "shop": they are a seasonable greeting to all readers who have got this far—may you all enjoy a very happy Christmas.

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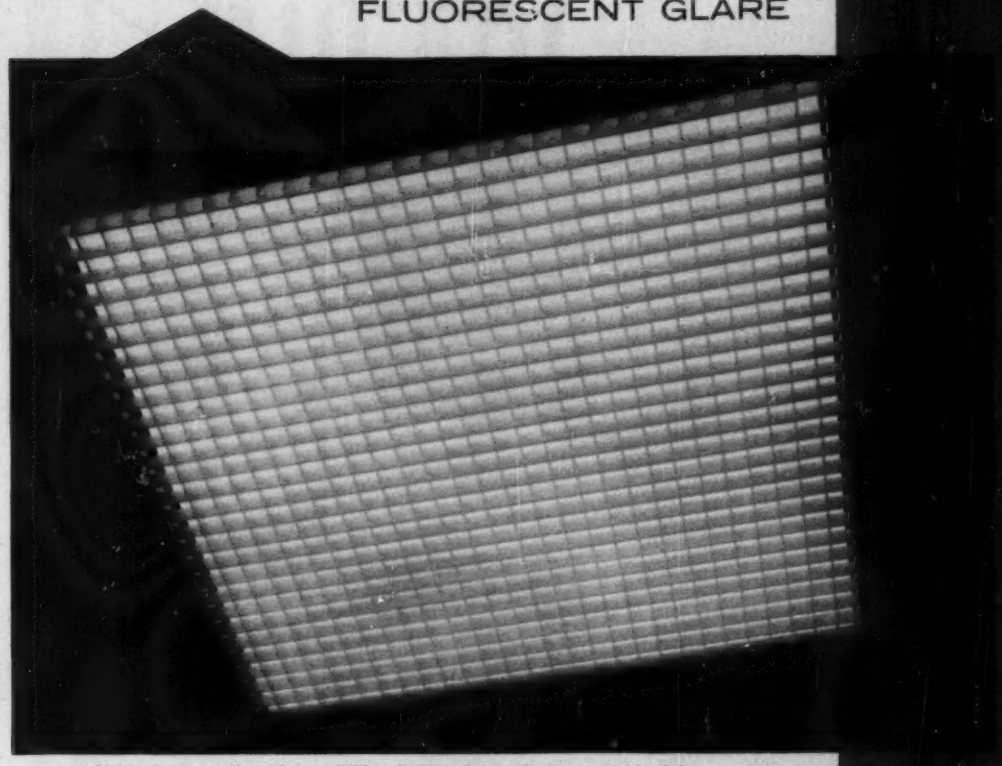

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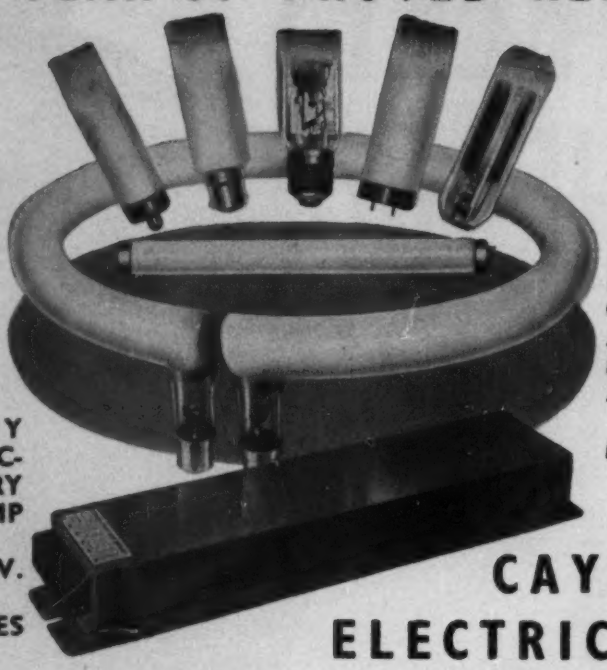

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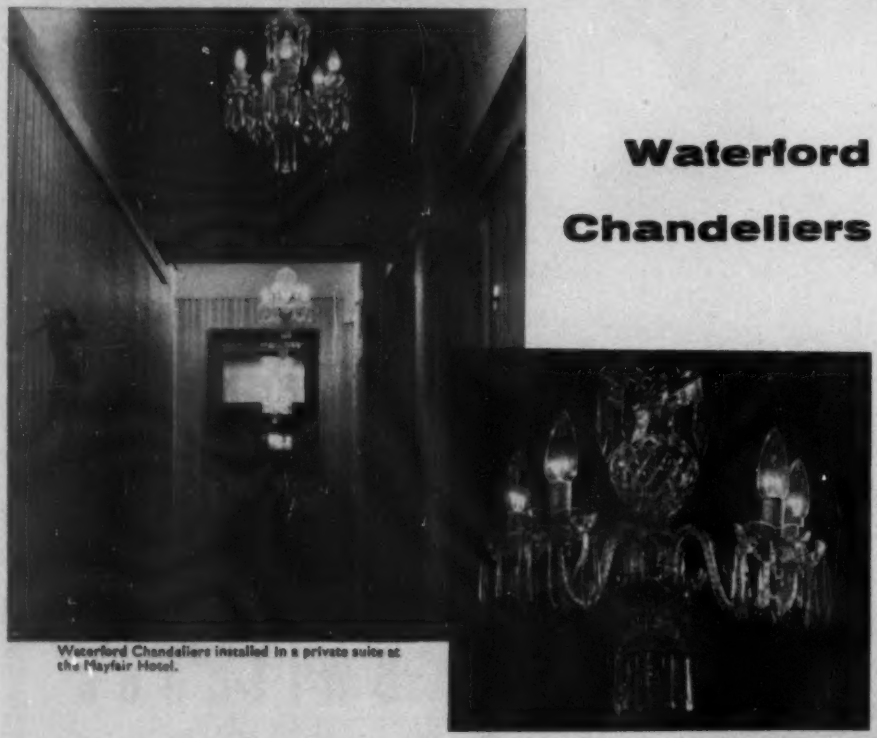

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Beautifully hand cut from full lead crystal, Waterford Chandeliers are available in sizes suitable for modern interiors.

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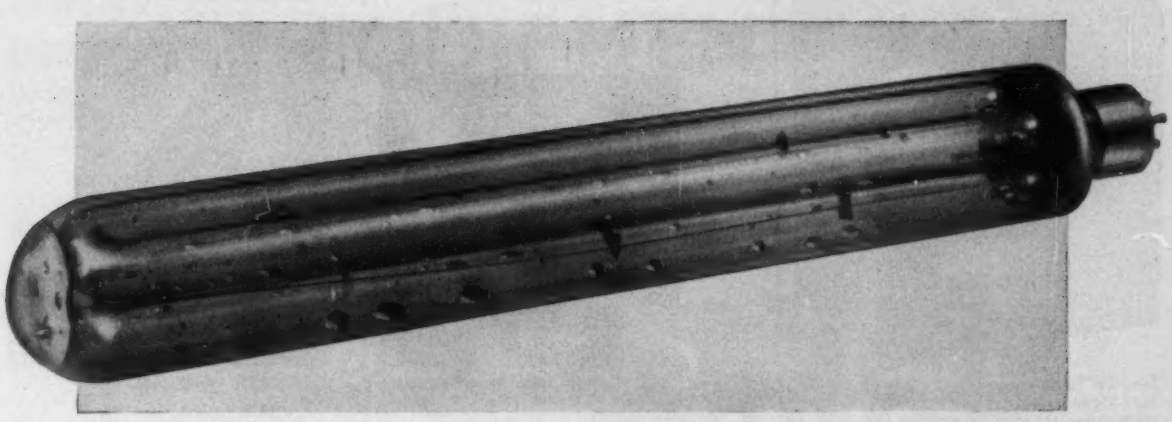
Osram Integral Sodium Lamps



From major highways to minor roads, the Osram Integral Sodium Lamp is proving itself an outstanding feature of modern lighting installations. The key to its performance is in its all-round dependability. The following features deserve your attention.

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  The integral jacket protects the tube in all atmospheric conditions.
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  Special sodium resistant glass minimises sodium migration—maintains uniform brightness along the length of the tube.
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  Built-in safety fuses protect the control gear should rectification develop at the end of life.
* **Simple Replacement**
  One piece Osram integral sodium lamps make replacements simple and are directly interchangeable with detachable jacket lamps.

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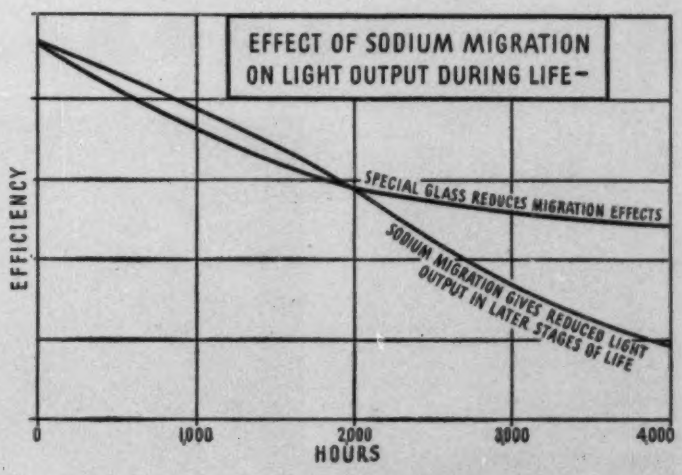

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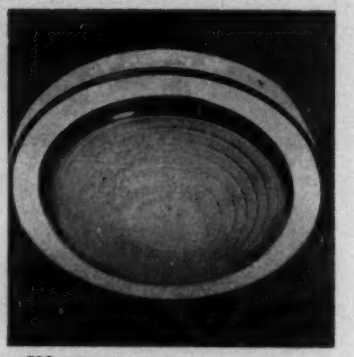

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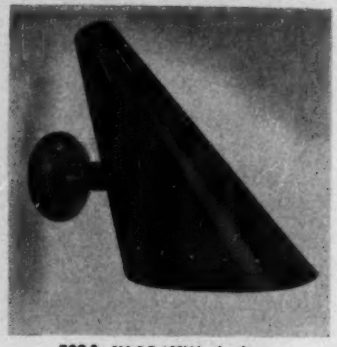

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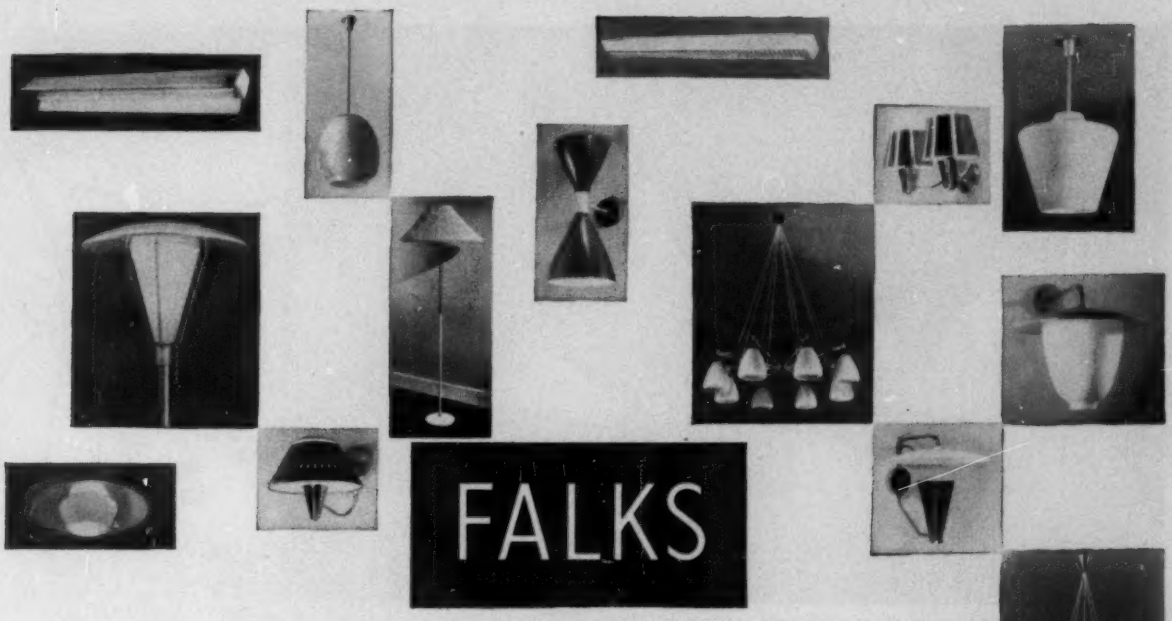

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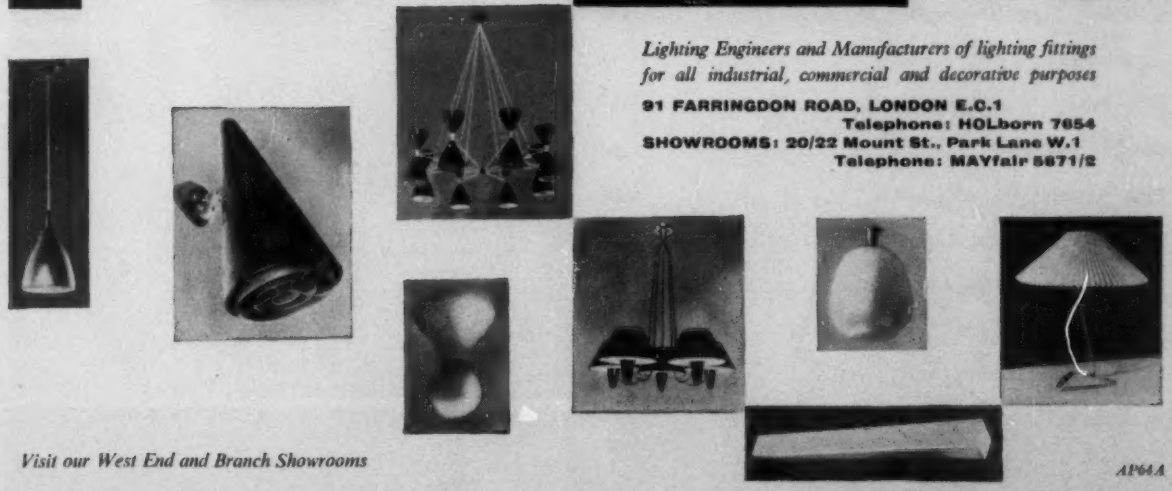

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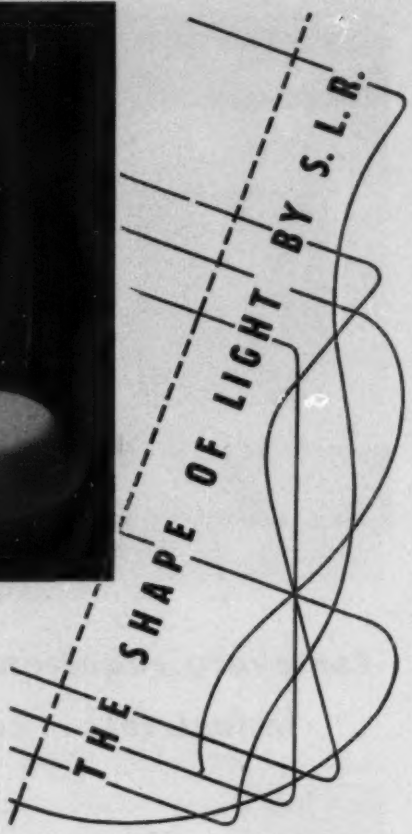

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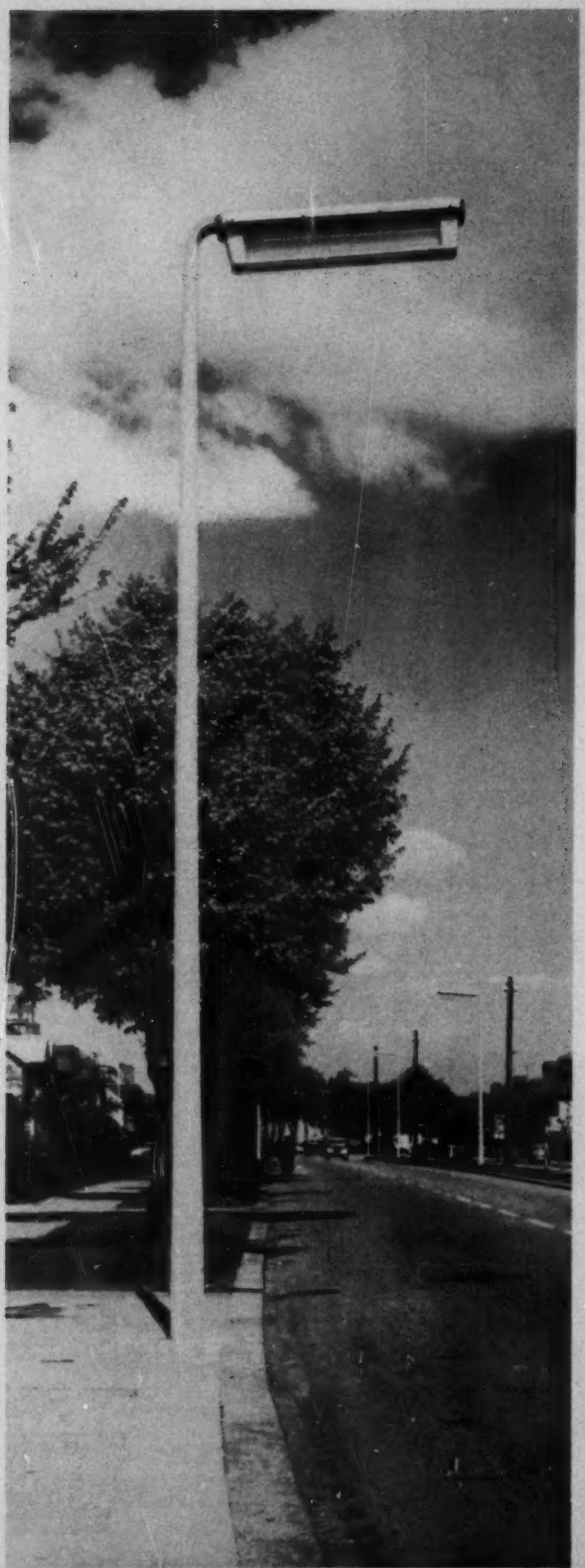
Published by The Illuminating Engineering Publishing Company Limited, at 32 Victoria Street, London, S.W.1. Printed by Knapp, Drewett and Sons Ltd. 30, Victoria Street, London, S.W.1, England.



STANTON

Prestressed Spun Concrete Lighting Columns

Stanton Type 8K/1 Spun Concrete Lighting Columns fitted with G.E.C. Z.8484 Fluorescent Lanterns at Bedford.

Photograph by courtesy of F. W. Dawkes, Esq., B.Sc. (Eng.), A.M.I.C.E., M.I. Mun. E., A.M.T.P.I., Borough Engineer & Surveyor.

The type shown is one of many Stanton designs approved by the Council of Industrial Design and acceptable to the Ministry of Transport for use on trunk roads.

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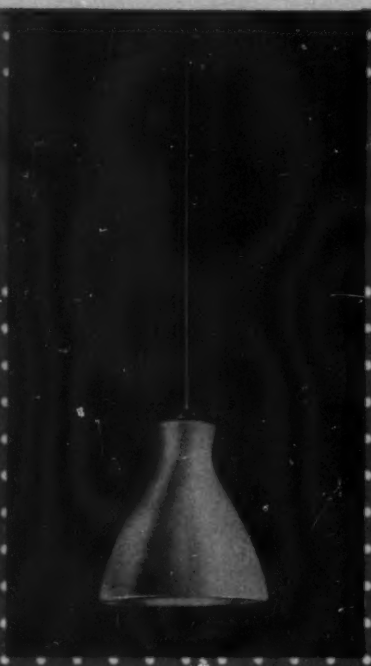
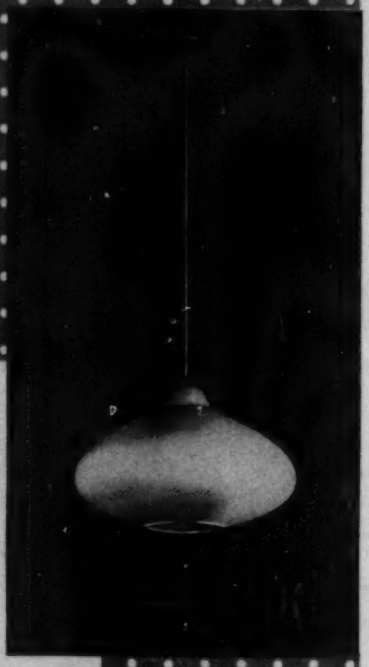


These illustrations are typical of many variations possible with the Sirius range of contemporary fittings. Shades are available in white satin opal and soft satin pink.



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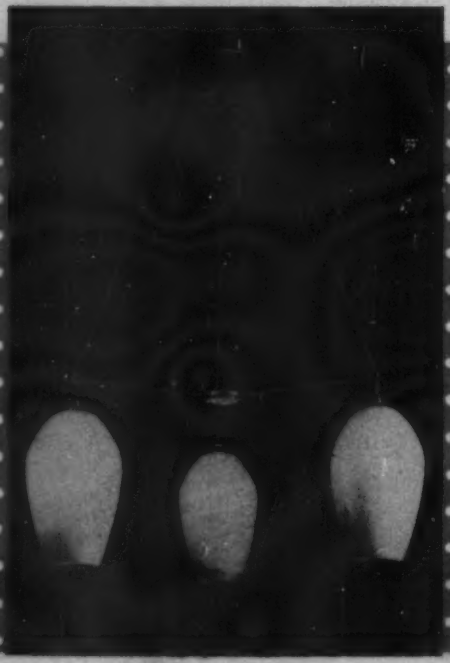

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